

## Chapter 2

# Intellectual Lineages and Theoretical Foundations

This chapter reconstructs the intellectual lineages and theoretical resources through which Generative Relational Economics (GRE) becomes conceptually possible. Its role within Part I is mediating. Chapter 1 located GRE within a historically changing economic, institutional, scientific, and technical environment; Chapter 3 will state GRE's disciplinary constitution and research programme. The present chapter occupies the interval between those tasks. Its objective is to identify the philosophical, social-historical, economic, normative, and formal traditions that supply GRE with concepts, distinctions, problems, and representational resources, while preserving the differences among those traditions.

The chapter therefore uses intellectual genealogy in a deliberately non-exclusive sense. A lineage may contribute a concept, a problem-form, a method of abstraction, a critique, or a formal language without becoming a direct ancestor of every GRE claim. The presence of a comparable relational, processual, historical, or generative idea in two traditions does not establish theoretical identity. Several of the traditions examined here disagree about ontology, value, agency, evidence, historical change, and normativity. Those disagreements are part of the theoretical material of GRE rather than obstacles to be removed in advance. The chapter accordingly treats comparison as a practice of locating convergences, differences, translation possibilities, and unresolved tensions.

The discussion is organized through progressive concretization. It begins with the most abstract conceptual conditions of inquiry: ontology, epistemology, appearance, perception, aesthetic judgment, curiosity, subjectivity, interpretation, relation, process, and emergence. These topics establish the vocabulary required to ask what kinds of realities economic analysis presupposes, how those realities become accessible, how subjects orient attention, and how relatively stable objects can arise within processes of change. The aim is methodological discipline. GRE should not allow a convenient formal model to determine its ontology implicitly, nor should it treat relation, process, or emergence as self-explanatory terms.

The next movement turns toward social and normative reality. Social facts, habits, norms, legal and governance facts, subject formation, value, justice, and nomos provide resources for understanding how economic objects become stabilized through

collective practice and institutional recognition. This layer is especially important because GRE examines realities whose causal efficacy may depend on recognition, classification, expectation, authority, and historically reproduced relations. The discussion therefore moves from abstract philosophical questions toward social forms in which relations acquire persistence and practical consequence.

The economic and political-economic sequence then reconstructs traditions that illuminate different dimensions of economic life. Classical political economy contributes problems of social wealth, production, labor, distribution, and social order. Marginalist and neoclassical economics contribute rigorous analyses of scarcity, choice, equilibrium, welfare, information, and allocation. Marxian and historical-material traditions foreground historically specific relations of production, accumulation, reproduction, contradiction, and transformation. Institutional economics, economic sociology, relational sociology, capability approaches, care and feminist economics, commons traditions, evolutionary economics, ecological economics, circular and regenerative thought, relational-value approaches, and justice theory each enlarge the field of economic questions in different directions. GRE draws from this plurality while retaining the possibility that a neighboring tradition may explain a particular problem more precisely than GRE does.

A further movement examines scientific and formal lineages. Systems theory, cybernetics, dynamical systems, complexity science, network and higher-order models, field-based and background-sensitive representations, and information or computational approaches provide languages for describing feedback, trajectories, multiscale organization, changing topology, distributed conditions, and computational limits. These resources are important for GRE because relational and generative claims often concern structures that evolve through time. Their use remains representational and problem-dependent. Formal similarity with a physical, biological, or computational system does not by itself establish that an economic system shares the same ontology or mechanism.

The chapter closes by locating Generative Relational Theory (GR) within this heterogeneous intellectual landscape and by identifying both convergences and unresolved theoretical problems. GR supplies the immediate meta-framework from which GRE develops, including ontological suspension, relational and representational layers, generative systems, trajectories, fields, and endogenous transformation of generative rules. The present book nevertheless develops only the GR foundations required for economics. GRE remains a domain-specific research programme whose claims must be justified within economic inquiry and remain open to correction from existing economics, adjacent disciplines, and later GR developments.

The resulting genealogy is therefore neither a catalogue of influences nor an argument for theoretical unification. It is an architecture of conceptual possibility. Its purpose is to show how a set of historically accumulated philosophical questions, economic traditions, normative concerns, and scientific formalisms can be placed into disciplined relation without being collapsed into a single vocabulary. The first section establishes that architecture explicitly; the sections that follow then examine its components in progressively more concrete form before returning, at the end of the chapter, to the theoretical position of GRE.

## 2.1 Architecture of the Intellectual Genealogy

This section establishes the organizing architecture for the chapter's intellectual genealogy. Its role is to specify how heterogeneous philosophical, social-historical, economic, normative, scientific, and formal traditions will be related before the chapter examines them individually. The objective is to provide a reading structure that preserves theoretical differences while making cumulative movement toward GRE visible. The discussion proceeds through four families of intellectual resources and then explains the principle of progressive concretization that connects them. The method is reconstructive and comparative: each lineage is approached according to the conceptual work it can perform, the questions it makes visible, and the limits that remain when it is translated into a generative relational framework.

### 2.1.1 Philosophical Foundations and Conceptual Primitives

The philosophical layer supplies the most abstract distinctions required by the rest of the book. Economic analysis ordinarily operates with entities, properties, states, relations, processes, events, values, subjects, observations, and representations. These terms can appear sufficiently familiar to function as background vocabulary, yet different theories assign them substantially different meanings. An entity may be treated as ontologically prior to its relations, as constituted through relations, or as a relatively stable configuration within an underlying process. A property may be intrinsic, relational, institutional, or representational. A state may describe an object at a moment, while a process may concern the transformations through which states, boundaries, or even the object itself change.

GRE requires these distinctions because its substantive claims depend on movement among several analytical levels. A firm can be treated as an administratively recognized entity, as an organization constituted by internal and external relations, and as a participant in generative processes that alter later capacities and institutional conditions. These descriptions can coexist, yet they answer different questions. The philosophical genealogy therefore provides conceptual discipline for deciding when a given description is appropriate and what commitments follow from using it.

Ontology and epistemology form one part of this foundation. Ontological questions concern the status of the realities invoked by analysis; epistemological questions concern the conditions under which those realities can be observed, inferred, represented, and revised. GRE's later use of ontological suspension depends on keeping these questions distinct. A model can operate effectively without resolving the ultimate metaphysical status of every object it contains, provided that its practical ontological commitments are explicit enough for the inquiry at hand.

Appearance, perception, salience, aesthetics, curiosity, phenomenology, and hermeneutics extend the philosophical foundation beyond ontology and epistemology in a narrow sense. Economic inquiry begins within a field of selective attention: some phenomena become visible, some relations become salient, and some questions are judged worthy of sustained inquiry. Aesthetic judgment is relevant here in its broad philosophical sense of orientation toward form, coherence, surprise, elegance, or generative promise. Curiosity concerns the movement from encounter

to question formation. Phenomenology and hermeneutics add problems of lived experience, situatedness, interpretation, language, and historically variable horizons of meaning. These topics matter because GRE eventually asks how subjects, values, knowledge, and economic possibilities become significant within relational systems.

Relation, process, becoming, and emergence then provide the conceptual bridge toward generative analysis. A relational vocabulary can describe constitution, dependence, position, and interaction; a processual vocabulary can describe continuity and transformation; emergence concerns relatively stable properties or structures that arise through interactions without being adequately specified by isolated components alone. GRE does not treat any one of these vocabularies as a final metaphysics. Their role in the genealogy is to provide alternative conceptual resources for economic objects that are constituted, reproduced, and transformed through time.

### **2.1.2 Social-Historical and Political-Economic Lineages**

The second family of lineages moves from abstract philosophical categories toward historically organized social reality. Social facts, institutions, norms, legal forms, habits, conventions, fields, roles, and relations of production provide vocabularies for explaining how recurrent patterns become durable enough to organize conduct. These traditions are important for GRE because many economically consequential objects possess causal efficacy through historically reproduced recognition and coordination. Property, contract, money, employment, corporate organization, administrative classification, and market participation all depend on institutional conditions that exceed the isolated characteristics of individual actors.

Historical-material traditions contribute a particularly important orientation. They direct attention toward the relation between material conditions, productive forces, relations of production, institutions, and historically specific categories of economic thought. Chapter 1 used this orientation to reconstruct why entity-centered allocation became a powerful economic abstraction and why contemporary transformations reopen questions of relation and generation. The present chapter turns from that historical diagnosis to the intellectual resources through which materiality, social relations, contradiction, accumulation, reproduction, and historical transformation have been theorized.

Institutional economics and economic sociology supply related resources from different directions. Rules, conventions, embeddedness, trust, reciprocity, path dependence, and organizational forms make visible the institutional conditions under which economic action becomes possible and intelligible. Relational sociology and social field theory shift attention toward positions, networks of dependence, fields of power, and the constitution of actors through relations. These traditions help GRE avoid treating economic relations as a thin layer added after independently completed subjects have already been defined.

The social-historical lineage also constrains the generality of GR concepts. A relational pattern observed in one historical formation does not automatically become a universal structure. Institutions can stabilize different subjects, classifications, and normative orders at different times. The same formal relation may therefore acquire different social meanings and causal consequences across historical settings. GRE's

relational language must remain sensitive to this historical specificity.

### 2.1.3 Economic and Normative Lineages

The third family contains economic and normative traditions that specify the substantive problems to which GRE must respond. Classical political economy foregrounds social wealth, production, labor, distribution, and the organization of economic order. Marginalist and neoclassical traditions develop powerful analyses of scarcity, preferences, choice, equilibrium, welfare, information, incentives, and allocation. Marxian traditions emphasize historically specific production relations, accumulation, social reproduction, exploitation, and structural transformation. GRE does not acquire coherence by selecting one of these traditions as a complete predecessor. Its theoretical problem-space emerges partly from their different strengths and unresolved tensions.

Later approaches widen the range of economically relevant objects. Capability and human-development approaches distinguish resources from the substantive opportunities into which persons can convert them. Care, feminist, and social-reproduction economics foreground dependency, care relations, reproductive labor, and forms of value that market accounting can underrecognize. Commons, cooperative, and solidarity traditions examine collective ownership, reciprocity, shared infrastructure, and governance arrangements that differ from both isolated private ownership and centralized administration. Evolutionary economics emphasizes variation, innovation, retention, routines, and coevolution. Ecological economics places economic activity within material, energetic, ecological, and intergenerational constraints.

Circular and regenerative approaches introduce questions of recirculation, retention, restoration, and the conditions under which productive activity sustains or transforms the systems on which it depends. Relational-value and relational-goods traditions provide vocabulary for forms of value located partly in relations themselves rather than solely in separately possessed objects. Justice theory adds distributive, procedural, relational, historical, and intergenerational questions. These lineages are especially important for GRE because generativity alone does not establish normative desirability. A process can generate capacities for some actors while generating dependence, exclusion, or ecological degradation for others.

The normative genealogy therefore accompanies the economic genealogy rather than appearing only after positive theory has been completed. Questions of value selection, recognition, participation, return, power, and justice influence which economic transformations are considered significant and how they are evaluated. GRE will later develop its own account of heterogeneous value and generative justice, but that development remains dependent on distinctions already elaborated in neighboring normative and economic traditions.

### 2.1.4 Scientific and Formal Lineages

The fourth family concerns scientific and formal languages capable of representing systems whose states, relations, and transformation conditions change through time. Systems theory and cybernetics contribute concepts of system-environment rela-

tions, feedback, regulation, control, self-organization, and adaptation. Dynamical-systems theory contributes state spaces, trajectories, attractors, bifurcations, and time-dependent dynamics. Complexity science contributes nonlinearity, emergence, adaptation, multiscale organization, and coevolution. Network science makes relational topology explicit, while hypergraph, higher-order, and multilayer approaches provide representations for interactions that exceed pairwise ties or occur across several relational layers.

Field-based formalisms provide another way to represent distributed conditions that influence actors across space, position, or configuration. Gauge and background-sensitive ideas supply more specialized conceptual resources for distinguishing meaningful structure from representational redundancy and for asking whether the background conditions of a model are fixed or themselves dynamic. GRE uses these ideas cautiously. Their value lies in the kinds of structural questions they make expressible, while their physical origins provide no automatic warrant for importing their ontology into social analysis.

Information theory, computation, simulation, and formal model construction add another dimension. They clarify limits on representation, tractability, inference, and experiment within complex systems. Computational methods can explore heterogeneous agents, evolving networks, counterfactual trajectories, and multiscale interactions that are difficult to analyze analytically. They also introduce dependencies on data, parameterization, algorithms, and model architecture. Formal capacity therefore enlarges the space of possible inquiry while preserving the need for empirical, historical, and interpretive validation.

The scientific lineage is consequently plural by design. GRE does not require every economic problem to be expressed through one universal formalism. Dynamical, network, field, categorical, geometric, algebraic, statistical, and computational representations can illuminate different structures. Their suitability depends on the object of inquiry, the available evidence, the scale of analysis, and the kind of claim being made.

### **2.1.5 Progressive Concretization toward Generative Relational Economics**

The architecture of the chapter moves through progressive concretization rather than through a hierarchy in which later traditions supersede earlier ones. Philosophical foundations clarify the concepts with which inquiry begins. Social-historical traditions show how those concepts acquire institutional and historical form. Economic and normative traditions specify substantive problems of production, allocation, value, capability, reproduction, ecology, power, and justice. Scientific and formal traditions provide representational languages for structures and processes that may be difficult to express in ordinary prose alone. Generative Relational Theory then brings selected elements of these lineages into a provisional meta-framework from which GRE develops as a domain-specific economic programme.

This movement preserves several kinds of difference. Conceptual similarity does not imply common ontology. Comparable mathematical structures do not imply common mechanisms. Shared concern with relation does not mean that embeddedness,

relations of production, network ties, care relations, legal relations, and field positions are interchangeable. Shared concern with generation does not make evolutionary selection, ecological regeneration, social reproduction, institutional emergence, and generative value instances of one already-settled process. The chapter therefore uses convergence as an invitation to comparison and further specification.

Progressive concretization also leaves room for reverse correction. Economic problems can expose weaknesses in abstract philosophical distinctions. Historical cases can reveal that a supposedly general relation is domain-specific. Empirical evidence can constrain a formal analogy. Normative analysis can show that a generative mechanism produces outcomes that require restriction or institutional counteraction. Existing economic theories may offer more precise accounts of particular mechanisms than GRE presently possesses. The genealogy therefore runs in more than one direction: inherited concepts make GRE possible, while the development of GRE can also reveal where those inherited concepts require revision.

The final movement toward GRE is accordingly integrative without aspiring to total theoretical synthesis. The chapter will first examine philosophical and social foundations, then political-economic and normative traditions, then scientific and formal lineages, before returning to GR and the unresolved integration of relation, value, and generativity. The resulting structure prepares Chapter 3 to define GRE as a research programme with explicit objects, commitments, limits, and open problems. Intellectual genealogy thus functions here as a map of conceptual possibility and theoretical constraint rather than as a claim of intellectual ownership or final unification.

## 2.2 Ontology, Metaphysics, and the Status of Reality

This section establishes the ontological vocabulary required by the remainder of Chapter 2 and by GRE's later substantive arguments. Its role is conceptual rather than adjudicative: the chapter needs a disciplined way to speak about entities, properties, states, relations, processes, and events without converting one useful description into a final metaphysical doctrine. The objective is therefore to reconstruct several major ontological orientations, identify the analytical work each can perform, and specify the limited commitments GRE requires from them. The discussion proceeds from substance and entity, through property and state, to relation, process, and event, before closing with the distinction between practical ontological commitment and ontological suspension. The method is comparative and reconstructive. Historical positions are treated as intellectual resources whose differences remain visible, while GRE adopts only those commitments required for economic inquiry.

### 2.2.1 Substance and Entity

The language of substance provides one of the longest-standing ways of organizing questions about what exists and what persists through change. Aristotle's *Metaphysics* gives substance a privileged place in the investigation of being and repeatedly asks what it is for something to count as a relatively primary bearer of predicates, change, and explanation (Aristotle 2016). The Aristotelian tradition is internally complex, especially once matter, form, essence, and actuality enter

the analysis. Its importance for the present genealogy lies less in a single doctrine than in the durable analytical image it helped stabilize: a world can be described through relatively identifiable things that possess characteristics, persist through some changes, and provide subjects about which further claims are made.

Economic analysis inherits a practical version of this image whenever it begins from persons, households, firms, assets, states, or organizations as identifiable units. Such entities can be counted, assigned rights, endowed with properties, observed at successive times, and entered into models as variables or agents. Chapter 1 showed why modern legal, accounting, administrative, and statistical institutions made this entity-centered mode of analysis especially productive. The metaphysical lineage therefore helps explain the conceptual ease with which economic inquiry can move from an observed unit to questions about what that unit owns, chooses, produces, owes, or receives.

An entity concept does not require the claim that the entity is metaphysically self-sufficient. A firm can be treated as one unit for accounting purposes while remaining internally differentiated by contracts, authority relations, knowledge flows, technologies, and organizational routines. A household can function as a statistical unit while its internal distribution and dependency relations remain economically consequential. Entity-level description is therefore best understood in GRE as a resolution of analysis: it identifies a relatively stable unit whose internal complexity can be bracketed when that complexity does not materially alter the question under study.

This distinction separates analytical entityhood from strong substance metaphysics. GRE requires entities because economic institutions and empirical methods frequently operate through them. It does not follow that entities are always ontologically prior to the relations through which they are constituted. The relevant question is local: whether treating a configuration as a unit preserves the structure needed for the explanation, comparison, or intervention at hand. Entity-centered analysis remains legitimate where that condition is satisfied, and relational analysis becomes necessary when the omitted constitution materially affects the result.

### 2.2.2 Property and State

Properties and states provide two further ways of describing relatively stable economic objects. A property attributes some characteristic to an entity or configuration: ownership status, income, liquidity, productive capacity, contractual position, or institutional membership may all be represented in this form. A state describes the configuration of an object or system at a specified moment or over a specified interval. In empirical and formal work, the distinction is often practical rather than metaphysically exhaustive. A property may be one component of a state, while a state may summarize a larger set of properties and relations relevant to subsequent change.

Analytical metaphysics provides one influential example of a more structured account. Armstrong's theory of states of affairs treats particulars, properties, and relations as constituents of facts or states of affairs rather than treating a world of bare things as sufficient in itself (Armstrong 1997). The importance of this position for GRE is illustrative. It shows that even within a broadly realist and entity-compatible meta-



physics, analysis can shift from isolated things toward structured configurations in which properties and relations are integral to what obtains.

Economic states are usually more modest constructions. A balance sheet, an employment status, a market position, or a network location is defined through a representational scheme that selects some dimensions and leaves others outside the immediate description. The state therefore depends on a choice of variables, categories, temporal resolution, and boundary. This dependence does not make the state arbitrary. A well-constructed state can preserve precisely those distinctions needed to explain an economic transition. The important requirement is that the representation remain explicit about what has been included and what has been suppressed.

GRE consequently treats property and state as analytically useful without granting either automatic ontological primacy. Some properties are intrinsic enough for a local purpose; others are relational or institutional. Ownership, for example, cannot be reconstructed adequately as a physical feature of an object because its economic force depends on a recognized normative and institutional relation. Likewise, a firm's "state" at a moment may include internal capabilities, external obligations, and network dependencies that cannot be assigned to the firm independently of its relations. The ontology appropriate to an economic state therefore follows the structure required by the question rather than a universal presumption that all economically relevant properties reside inside isolated entities.

### 2.2.3 Relation and Relational Reality

Relational approaches become necessary when the identity, capacity, meaning, or causal efficacy of an economic object depends materially on its connections to other objects or structures. The intellectual lineage for this shift is diverse. Cassirer's *Substance and Function*, for example, reconstructs a movement in modern scientific thought from thing-concepts toward functional and relational forms of conceptualization (Cassirer 1923). GRE does not inherit Cassirer's epistemology wholesale, yet the contrast is valuable because it makes visible a recurrent theoretical possibility: explanatory priority can move from the isolated bearer of properties toward the system of relations through which an object is determined.

Relation in GRE is correspondingly broader than an observed social tie. Exchange, ownership, credit, employment, authority, recognition, dependence, membership, care, trust, informational access, and institutional obligation can all have relational structure. Some relations are dyadic, while others involve organizations, publics, fields, or higher-order configurations. A relation may also be partly symbolized through contracts, accounts, classifications, or digital records while extending beyond any single representation of it.

The notion of *relational reality* adds a further claim. GRE uses the term for configurations that are generated and sustained through relations, acquire sufficient persistence to participate in subsequent causal processes, and can in turn modify the relations through which they are reproduced. Money, organizational authority, a corporate role, a recognized entitlement, or a durable relation of trust can be economically real in this sense even when their existence depends on institutional recognition and collective practice. The criterion concerns persistence and causal participation

within the relational system; it does not settle the ultimate metaphysical category to which the phenomenon belongs.

This formulation is important because social dependence does not imply causal insignificance. An institutional object can be historically contingent and still organize behavior, access, expectation, and resource flow. Conversely, repeated observation of a category does not by itself establish that the category corresponds transparently to a deeper relational structure. The distinction between relational reality and its manifestation will be developed in Chapter 4. At the present genealogical stage, the relevant point is that relation can be constitutive rather than merely external, while the strength and type of that constitutive claim remain open to domain-specific argument.

Relational analysis therefore does not require a universal doctrine that relations are more real than entities. It requires the weaker methodological possibility that some entities, properties, and capacities are intelligible only through the relations that sustain them. GRE adopts this possibility because economic institutions routinely create objects whose practical reality depends on recognition, obligation, access, classification, and coordinated expectation. The later philosophy-of-relation sections of this chapter will examine internal and external relations in greater detail; the present subsection establishes only the ontological space in which relational constitution can be taken seriously.

#### 2.2.4 Process and Event

Process-oriented metaphysics shifts attention from what a thing is at one moment toward the activity through which relatively stable forms arise, persist, and change. Whitehead's *Process and Reality* offers one of the most systematic twentieth-century examples, organizing its metaphysics around event-like “actual occasions” and the processes through which they become determinate (Whitehead 1929). Process philosophy more broadly treats becoming, activity, and temporal development as philosophically fundamental resources rather than secondary modifications of a fully given world of static things.

GRE uses this lineage selectively. Economic entities often possess histories that matter to their current capacities. A firm is shaped by accumulated routines, investments, contracts, personnel, technologies, and past decisions. A credit relation develops through sequences of obligation and repayment. Institutional trust can strengthen or erode through repeated interaction. In such cases, a snapshot can be descriptively correct while remaining explanatorily incomplete because the path through which the current state was generated affects what can happen next.

An event provides a complementary analytical unit. Events mark changes that are localized enough to distinguish within a trajectory: entry into a contract, bankruptcy, a regulatory decision, a technological adoption, a strike, a merger, or a market disruption can all function as economic events. Event analysis becomes generative when the significance of the event is assessed through the relations and conditions it changes. The same nominal event may produce different consequences when it occurs in different institutional, historical, or relational configurations.

Process and event therefore permit a different organization of economic explana-

tion. An entity can be reconstructed as a relatively persistent outcome within ongoing processes; a state can be understood as a temporal cross-section of a trajectory; an event can be treated as a transformation within that trajectory; and relations can themselves form, strengthen, weaken, or dissolve over time. None of these descriptions requires GRE to adopt Whitehead's complete speculative metaphysics. The intellectual contribution lies in making temporal generation analytically primary when persistence and transformation cannot be understood from static attributes alone.

This processual orientation also prepares the later distinction between relational and generative analysis. Relational analysis can reconstruct which connections constitute a system at a given time. Generative analysis asks how those relations participate in producing later states, capacities, subjects, constraints, and possibilities. Process language therefore becomes especially useful when the object of analysis includes transformation of the conditions under which subsequent transformation occurs.

### 2.2.5 Ontological Commitment and Ontological Suspension

Every economic inquiry makes some ontological commitments, even when it does not present itself as metaphysics. To model households, preferences, firms, expectations, institutions, network ties, capabilities, or fields is to treat some distinctions as sufficiently real for the purposes of the inquiry. Quine's classic discussion of ontology helped make this problem explicit by linking theory to the question of what it says there is (Quine 1948). GRE accepts the practical force of this insight: a model or explanation cannot operate without specifying the objects, relations, properties, or processes over which its claims range.

The relevant commitments can nevertheless remain local and revisable. A researcher may commit to the existence of firms as administratively and causally meaningful units without resolving whether firms possess an ultimate metaphysical status independent of law, practice, and recognition. A network model may commit to particular actors and relations for one research question while acknowledging that another representation could redraw the relevant boundary. A field representation may be useful for describing distributed influence without establishing that a literal field constitutes the fundamental ontology of economic reality.

GRE names this discipline *ontological suspension*. The term has a family resemblance to the phenomenological practice of suspension associated with Husserl's epoché, in which the natural attitude toward objects is bracketed so that another mode of analysis becomes possible (Husserl 2012). GRE's use is narrower and domain-specific. It does not reproduce Husserl's transcendental project. Ontological suspension in GRE means withholding stronger metaphysical conclusions than the economic inquiry requires while preserving enough provisional commitment for explanation, measurement, comparison, and action.

Ontological suspension therefore differs from ontological indifference. The researcher must still state what is being treated as an entity, relation, property, process, event, subject, or institutional fact. The suspension concerns the escalation from a successful analytical commitment to a universal metaphysical claim. A model that represents organizations as nodes may be adequate for one task without proving that

organizations are fundamentally node-like entities. A process model may illuminate path dependence without proving that all economic reality is process. A relational account may explain subject formation without proving that relation is the ultimate substance of the world.

This position also creates room for theoretical pluralism. Armstrong's states of affairs, Cassirer's functional concepts, Whitehead's process metaphysics, Quine's account of ontological commitment, and Husserl's practice of suspension arise from different philosophical projects and cannot be merged into a single doctrine without substantial loss (Armstrong 1997; Cassirer 1923; Whitehead 1929; Quine 1948; Husserl 2012). GRE draws a methodological lesson from their juxtaposition: different ontological vocabularies can disclose different structures, while the strength of commitment should follow the explanatory burden of the local problem.

The resulting ontological stance is deliberately modest. Entities remain available where stable units matter; properties and states remain available where attributes and configurations matter; relations become constitutive where identity or capacity depends on connection; processes and events become central where histories and transformations matter. GRE begins from this plurality and suspends the demand for a final metaphysical settlement. The next section turns from the status of these proposed realities to the epistemic problem that follows immediately from them: the conditions under which any of them can be observed, inferred, justified, and revised.

## 2.3 Epistemology and the Limits of Knowing

This section establishes the epistemic vocabulary through which GRE can later distinguish observation, evidence, inference, interpretation, representation, and justified economic claims. Its role is to connect the ontological plurality developed in Section 2.2 with the practical problem of knowing a world that is only partially accessible through records, measurements, models, institutions, and situated observers. The objective is to recover several major epistemological lineages without treating any single one as a complete theory of economic knowledge. The discussion proceeds from knowledge, evidence, and justification to partial observation, inferential underdetermination, perspectival representation, and finally epistemic humility and revisability. The method is reconstructive and comparative: each lineage is read for the analytical discipline it contributes to GRE, while stronger claims about the ultimate nature of knowledge remain open.

### 2.3.1 Knowledge, Evidence, and Justification

Epistemology begins from a distinction that is elementary in form and demanding in practice: possessing a belief, receiving evidence, and being justified in a conclusion are different epistemic achievements. Economic inquiry depends on this distinction because almost every substantive claim passes through layers of mediation. A price series is a record generated by a measurement and institutional system; a household category is produced through definitions and sampling procedures; a causal estimate is obtained through a model that combines observations with assumptions; a historical interpretation is reconstructed from traces that survived unevenly. Evidence

therefore enters inquiry through procedures that determine what is observed, how it is represented, and what inferential work it can legitimately support.

The classical analysis of knowledge in terms of justified true belief provided one influential way to organize the relation among truth, belief, and justification. Gettier's short 1963 paper became important because it demonstrated that justified true belief can arise in cases where the connection between justification and truth is epistemically defective (Gettier 1963). GRE does not require a resolution of the Gettier problem. The relevance of this episode lies in the discipline it imposes: a conclusion can appear well supported and happen to be correct while the route connecting evidence to conclusion remains inadequate. In economic analysis, similar caution applies whenever a model fits observed outcomes for the wrong structural reason, a proxy tracks a target only under a temporary institutional configuration, or a classification produces apparently accurate aggregate patterns while obscuring the mechanism that generated them.

Evidence also acquires meaning only in relation to a claim. The same observation can bear differently on different hypotheses, and the same dataset can support descriptive, predictive, causal, or normative arguments with different strengths. Longino's account of scientific inquiry places particular emphasis on this contextual relation between evidence and hypothesis, arguing that evidential relevance depends on background assumptions and that objectivity is strengthened through critical interaction within a community of inquiry (Longino 1990). This perspective is valuable for GRE because relational economic claims often depend on background choices about boundaries, scales, categories, temporal windows, and what counts as a consequential relation.

The epistemic problem is therefore structured rather than binary. GRE needs to ask what has been observed, what has been inferred, what assumptions mediate the inference, what alternative interpretations remain live, and what degree of confidence the available support warrants. These questions become especially important when economic phenomena are relationally distributed or generatively extended through time. A claim about present allocation may be well evidenced at the level of immediate transfers while remaining weakly evidenced at the level of long-run capability formation. A claim about institutional membership may be directly documented while its effect on participation is inferred through a more contestable model. Epistemic discipline requires keeping these evidential layers distinct.

Knowledge in GRE is consequently treated as warranted enough for a specified analytical purpose rather than as a license for unrestricted extrapolation. The required warrant varies with the claim. Describing an observed relation, attributing a generative mechanism, predicting a future trajectory, and recommending an intervention place different burdens on evidence and justification. This graded view prepares the later methodological distinction between evidence for relational claims and evidence for generative claims, while preserving a more general philosophical principle: the strength of a conclusion should track the strength and structure of the route by which it is justified.



### 2.3.2 Observation and Partial Access

Observation provides the empirical contact through which economic inquiry becomes answerable to a world beyond its concepts, yet observation is always selective in resolution, timing, instrumentation, and accessibility. An economy cannot be observed from a position outside all of its institutions. Researchers encounter transaction records, surveys, contracts, prices, administrative files, interviews, archives, digital traces, and behavioral measurements. Each source makes some relations visible while leaving others indirect, latent, strategically concealed, historically lost, or outside the chosen boundary.

Van Fraassen's constructive empiricism gives one influential philosophical form to the distinction between empirical adequacy and stronger realist commitment. In *The Scientific Image*, the aim of science is reconstructed around empirical adequacy, with careful attention to the distinction between observable phenomena and claims that extend beyond them (Fraassen 1980). GRE does not inherit constructive empiricism as a complete epistemology. Its relevance lies in the caution it provides against treating successful representation of observed manifestations as automatic disclosure of every underlying structure. A model may organize observable economic regularities effectively while several different relational mechanisms remain compatible with those regularities.

Observation is also mediated by instruments and representational systems. Giere's scientific perspectivism develops this point by treating both human observation and instrument-mediated observation as perspectival, while models represent selected aspects of the world for specific purposes (Giere 2006). The term *perspective* here should not be reduced to personal opinion. A perspective can be technically disciplined, collectively stabilized, and highly reliable within its domain. Its epistemic significance is that every observation has a standpoint defined by what the apparatus can register, how outputs are transformed, and which differences are preserved.

This perspective-sensitive view maps directly onto relational economic inquiry. A network dataset observes relations that have been operationalized as edges; an accounting system observes transactions within a reporting boundary; a legal record observes relations recognized by a legal category; an ethnography observes situated practices through prolonged participation; a satellite or platform dataset observes patterns through a technical sensing and classification architecture. None of these accesses the economic system in the same way. Their differences can be productive because convergent, divergent, or complementary observations expose different aspects of the same relational configuration.

Partial access also has a temporal dimension. Some economic relations are visible only retrospectively because their significance emerges through later consequences. Others disappear before systematic observation begins. Still others become observable only after an institution creates a category, reporting requirement, or technical infrastructure capable of recording them. Chapter 1 already showed how administrative and statistical systems expand observability while participating in the construction of the objects they measure. The epistemological consequence is that absence from a dataset can reflect nonexistence, nonrecognition, nonmeasurement, concealment, archival loss, or a mismatch between the phenomenon's timescale and the ob-

servation window.

GRE therefore treats observability as a relation among phenomenon, observer, instrument, category, institution, and historical moment. This formulation supports empirical realism about the consequences of observed relations while preserving caution about completeness. Partial access can yield strong knowledge when the domain of the claim is explicit. It becomes misleading when a partial representation is silently expanded into a total description of the relational system.

### 2.3.3 Inference and Underdetermination

Inference extends inquiry beyond what is directly observed. Economic reasoning routinely moves from records to latent variables, from associations to mechanisms, from samples to populations, from observed histories to counterfactual alternatives, and from present states to future trajectories. These movements are indispensable because economically consequential structures are often distributed across relations or expressed through effects that cannot be read directly from any single observation. Their legitimacy depends on the assumptions connecting evidence to conclusion.

Duhem's analysis of physical theory provided an early and influential account of the difficulty of testing a single hypothesis in isolation. Experimental consequences depend on a wider theoretical and instrumental setting, so recalcitrant evidence can leave open several possible revisions within the system of assumptions (Duhem 1954). Quine later generalized a holistic orientation in his critique of reductionism, emphasizing that statements confront experience within wider webs of belief rather than as independently testable units (Quine 1951). The subsequent literature distinguishes several forms and strengths of underdetermination; the durable epistemic point is that a body of evidence can be compatible with more than one explanatory or theoretical reconstruction (Stanford 2023).

The economic relevance is immediate. An observed decline in labor share can be compatible with technological change, market concentration, institutional change, globalization, sectoral composition, measurement shifts, or combinations of these processes. A correlation between institutional membership and economic security can reflect causal protection, selection into membership, common background conditions, or reciprocal reinforcement. Relational settings add further ambiguity because interference, feedback, and higher-order dependence can make isolated-unit inference inadequate. Generative settings deepen the problem when several trajectories can produce similar present manifestations.

Underdetermination does not make inference futile. It changes the form of epistemic responsibility. Researchers can make assumptions explicit, compare rival mechanisms, seek discriminating evidence, report partial identification, and state which conclusions remain invariant across plausible alternatives. Manski's work on identification offers a particularly useful economic analogue: when data and weak assumptions identify a set of possible conclusions rather than a unique point, the identified set itself can be the appropriate empirical result (Manski 2008). This approach is compatible with GRE's broader commitment to preserving uncertainty when stronger precision would depend on assumptions the evidence cannot sustain.

The distinction between underdetermination and arbitrariness is essential. Ev-

idence can rule out many explanations while leaving several serious alternatives. Historical knowledge, institutional detail, qualitative evidence, formal structure, and comparative cases can narrow the space further. Methodological plurality therefore becomes epistemically substantive: different methods may constrain different parts of an inferential problem. A statistical model can quantify a regularity, process tracing can test an intermediate mechanism, archival evidence can reconstruct sequence, and ethnographic observation can clarify categories that a dataset treats as given.

GRE consequently treats inference as a structured movement from evidence through assumptions to claims whose scope and uncertainty remain visible. Strong generative claims require more than temporal succession or association. They require evidence for the mechanism, conditions, trajectory, and alternative explanations appropriate to the problem. This burden will later become a central feature of the methodology of generative relational inquiry.

### 2.3.4 Observer, Representation, and Perspective

Economic knowledge is produced by observers who occupy positions within the world they study and who rely on representational systems that select, aggregate, and stabilize features of that world. The observer can be an individual researcher, a statistical agency, a court, a firm, a platform, a community, or an automated sensing and classification system. Each operates through capacities and constraints that affect what can be registered and how observations become evidence.

Giere's perspectivism is useful here because it treats perspectival representation as compatible with disciplined scientific knowledge. Scientific models do not reproduce reality in exhaustive form; they represent selected aspects under conditions of use, and their adequacy is evaluated relative to the purposes and systems through which they are applied (Giere 2006). For GRE, this suggests a way to avoid two symmetrical errors. One error treats a representation as a transparent duplicate of relational reality. The other treats perspectival mediation as eliminating the possibility of objective constraint. A representation can be selective and still be empirically accountable.

Longino adds a social dimension to this account. Scientific objectivity, on her contextual empiricist view, is strengthened through publicly accessible criticism, uptake of criticism, shared standards, and sufficiently distributed authority within communities of inquiry (Longino 1990). GRE draws from this lineage a procedural insight rather than a complete sociology of knowledge. Because economic representations carry institutional consequences, their reliability depends partly on whether assumptions and classifications can be contested by differently situated observers who possess relevant evidence.

Representation also participates in economic reality. A credit score, unemployment category, property title, accounting classification, risk rating, or eligibility status can begin as a representation and then alter access, pricing, obligations, behavior, and future data. The observer–representation relation is therefore potentially reflexive: observing and classifying can modify the relational system that later observations attempt to describe. Hacking's work on historical ontology and classificatory practices provides an important intellectual precedent for treating classifications as historically situated and potentially consequential for the objects and practices orga-



nized around them (Hacking 2002).

Perspective in GRE must therefore be indexed at several levels. There is a spatial and institutional position from which observation occurs, a representational scheme through which differences are encoded, a temporal position from which a trajectory is interpreted, and a normative position that influences which outcomes are judged salient. These dimensions can overlap without being identical. A statistical agency and an affected community may observe the same institution through different evidential infrastructures; a later historian may possess evidence unavailable to participants; an automated model may detect regularities while lacking contextual knowledge needed to interpret their significance.

The epistemic task is to preserve these perspectival conditions as part of the claim rather than erase them after analysis. Doing so improves comparison across representations, clarifies disagreements, and makes later re-epistemization possible when new observers, methods, or historical positions reveal structures that earlier representations could not register.

### 2.3.5 Epistemic Humility and Revisability

Epistemic humility follows from the preceding structure of inquiry. Evidence is mediated, observation is partial, inference depends on assumptions, representations are perspectival, and economic systems can change while they are being studied. Humility in this context concerns calibration rather than generalized skepticism. A claim should state the domain in which it is warranted, the uncertainty that remains, and the conditions under which revision would become appropriate.

Popper's philosophy of science supplied one influential twentieth-century model of disciplined revisability. His account of falsifiability and critical testing rejected the treatment of scientific theories as finally verified and emphasized the continuing exposure of theoretical systems to severe tests (Popper 2002). GRE does not adopt falsificationism as a universal methodology. Historical, interpretive, institutional, and relational claims often interact with evidence in ways that cannot be reduced to a single decisive test. The broader lesson retained here is that a research programme should specify how evidence can challenge its claims and should preserve the possibility of correction.

Revisability operates at more than the level of propositions. New evidence can change an estimate; a new method can change what becomes observable; a new institution can change the meaning of a category; a historical rupture can invalidate a previously stable relation; a new theoretical language can reorganize the object of inquiry. Hacking's historical ontology makes this temporal dimension especially salient by examining how categories, possibilities of description, and objects of knowledge emerge within historically changing styles of reasoning (Hacking 2002). Economic knowledge therefore needs versioned concepts as well as updated data.

Longino's social account of objectivity adds another form of revisability: criticism can originate from differently positioned participants whose experiences expose assumptions that a homogeneous research community leaves unexamined (Longino 1990). This is particularly relevant for relational inquiry because the observer may occupy only one position within a network of dependence, authority, care, or insti-

tutional access. Incorporating contestability into research practice can expand the evidential field without implying that every perspective has equal support for every claim.

For GRE, epistemic humility has three practical consequences. First, claim strength should remain proportional to evidential reach. Second, competing representations and unresolved alternatives should be preserved when they remain materially plausible. Third, research records should retain enough provenance for future investigators to reconstruct how a conclusion was produced. These commitments prepare the later emphasis on historical re-epistemization: a claim may become weaker, stronger, or differently interpretable when methods, evidence, categories, or historical position change.

The section therefore closes with an epistemology suited to an open research programme. Knowledge remains possible because evidence constrains inquiry, methods can be criticized, representations can be compared, and claims can be tested against consequences. Knowledge remains revisable because access is partial and the objects of economic inquiry are themselves historically dynamic. GRE's epistemic stance is consequently neither certainty nor indifference. It is disciplined commitment under conditions that remain explicit enough for later correction.

## **2.4 Appearance, Perception, and Salience**

The preceding section examined how knowledge is constrained by partial observation, inference, representation, and perspective. The present section moves one conceptual step earlier and asks how something becomes available to an observer as an object of perception, attention, or recognition at all. Its role in the intellectual genealogy is therefore reconstructive rather than primarily constructive: it surveys several traditions that have treated appearance, perception, attention, salience, visibility, and recognition as structured phenomena instead of neutral transmission from an already given world to an isolated subject. Phenomenology, ecological psychology, classical psychology, behavioral economics, political philosophy, and recognition theory provide different answers to this problem. They should not be collapsed into a single relational theory, because they differ in object, method, and ontological commitment. Taken together, however, they establish an important condition of possibility for later GR inquiry: what becomes available for judgment depends on relations among phenomena, perceivers, practices, institutions, and historical conditions of access. The discussion proceeds from appearance and manifestation, through perception and world-disclosure, to selective attention, social visibility, and finally a limited synthesis of the relational conditions of appearance.

### **2.4.1 Appearance and Manifestation**

A long philosophical problem precedes contemporary theories of perception: what appears need not be identical with what exists, and what exists need not appear in the same way from every position. The distinction is elementary, yet it structures much later epistemology. An appearance is never merely an additional object placed beside reality. It is the manner in which something is given, disclosed, presented,

or made available under determinate conditions. The philosophical importance of appearance therefore lies in the relation between what is encountered and the conditions under which it can be encountered.

Phenomenology gives this problem one of its most systematic modern formulations. In Merleau-Ponty's *Phenomenology of Perception*, perception is approached through the phenomenal field, embodiment, figure-ground organization, spatial orientation, and the practical involvement of the perceiving subject in the world (Merleau-Ponty 2012). The perceived object is consequently not reconstructed as a bundle of independent sensory data to which meaning is added only afterward. It appears within a field whose organization already matters for what becomes determinate. Background and foreground, orientation and movement, familiarity and ambiguity are constitutive features of perceptual experience.

This line of thought is important for the present genealogy because it weakens a simple picture in which reality first exists as a complete set of determinate objects and perception subsequently copies those objects into consciousness. Phenomenological accounts instead direct attention to modes of givenness. The same physical configuration can appear differently as bodily position, practical orientation, prior familiarity, or surrounding context changes. Such variability does not by itself imply arbitrariness. It indicates that appearance has conditions.

The term *manifestation* can be used more cautiously as an analytical companion to appearance. A process, relation, institution, or condition may become accessible through traces, effects, expressions, or events without being exhausted by them. An observed price movement can manifest a change in expectations without uniquely identifying the process that generated it; an archival record can manifest a historical practice without preserving every relation through which the practice acquired meaning; a statistical disparity can manifest an inequality while leaving its generative history open to further inquiry. This distinction is consistent with the epistemic restraint established in Section 2.3: manifestation provides evidence, while the route from manifestation to explanation remains inferential.

Political philosophy adds another meaning of appearance. Arendt's account of the public realm in *The Human Condition* gives appearance a specifically human and political significance. Human plurality becomes worldly through speech and action before others; appearance is connected to a common world in which persons become manifest to one another and in which action can initiate processes whose consequences exceed the actor's control (Arendt 1958). Arendt's concern is not perceptual psychology, and her vocabulary should not be identified with phenomenological appearance. Her work nevertheless adds an important dimension to the genealogy: appearing can be socially and politically organized. A person or action may be physically present while lacking the public conditions under which that presence becomes consequentially visible.

These philosophical lineages leave several distinctions available for later use. Reality, manifestation, perceptual appearance, and public appearance need not coincide. What is real can remain unmanifested; what is manifested can remain unnoticed; what is perceived can remain socially insignificant; and what becomes publicly visible can do so through institutions that shape the terms of visibility. The significance of these distinctions for GR is preliminary at this stage. They establish that access to

a relational world is itself structured and that the conditions under which something appears deserve analysis alongside the thing that appears.

### 2.4.2 Perception and World-Disclosure

Theories of perception differ sharply over the relation among sensory information, the perceiving organism, the environment, and practical action. For the intellectual genealogy developed here, two traditions are especially useful because each rejects a purely atomistic picture of perception while doing so in a different way: phenomenology emphasizes embodied and situated experience, whereas ecological psychology emphasizes organism–environment structure and the information available within it.

Merleau-Ponty's phenomenology locates perception in embodied orientation. The body is not treated merely as one object among others that subsequently supplies data to an observing mind. Bodily capacities, habitual orientation, movement, and spatial involvement participate in the disclosure of a meaningful world (Merleau-Ponty 2012). A chair appears as sittable, a corridor as traversable, a familiar room as already organized around possible movement. Such examples should not be reduced to propositions consciously inferred by the subject. Their philosophical role is to show that practical significance can be present in the organization of perception itself.

Gibson's ecological approach reaches a related but theoretically distinct conclusion. His account of affordances emphasizes what environments offer animals relative to their capacities, thereby treating organism and environment as complementary terms in perceptual analysis (Gibson 1979). The affordance of a surface, opening, object, or path depends neither on an isolated list of physical properties nor on unconstrained subjective attribution. It depends on relations between environmental structure and the capabilities of an organism. Gibson's theory of direct perception differs from phenomenology in method and theoretical commitments, yet both traditions make it difficult to regard practical perceptual significance as a property of isolated objects considered independently of a perceiver's mode of access.

The expression *world-disclosure* is useful for organizing this part of the genealogy if it is kept conceptually modest. A mode of perception or practice can disclose a domain of relevant objects, possibilities, and obstacles without implying that this disclosed world is metaphysically self-contained or epistemically complete. A trained radiologist, a novice reader of an image, and an automated classifier can confront the same visual field while discriminating different structures. A lawyer, accountant, worker, and regulator can encounter the same institution while different possibilities, constraints, and categories become practically salient to each. Training, authority, instrumentation, bodily capacity, language, and institutional position all affect what can be distinguished and acted upon.

This point becomes particularly important when perception is technologically mediated. Maps, dashboards, interfaces, rankings, diagnostic systems, search engines, and models do not simply add information to an unchanged field of perception. They reorganize what can be made present, at what resolution, and in what order. A dashboard may disclose deviations that unaided observation could not track while concealing the processes through which the underlying variables were constructed. A

recommendation interface may disclose an enormous cultural archive while arranging that archive through selection criteria invisible to the user. The genealogy of world-disclosure therefore extends naturally toward the study of technical and institutional mediation.

No single theory surveyed here establishes the later GR position. Phenomenology is concerned with lived and embodied perception; Gibson develops an ecological theory of perception; technical mediation introduces additional problems that neither vocabulary alone resolves. Their contribution is instead foundational. They make available the idea that perception is structured through relations among capacities, environments, practices, and mediating arrangements. Later GR analysis can inherit that problem without claiming that these traditions already contain GR in implicit form.

### 2.4.3 Attention and Salience

Even within what is perceptually available, only some differences become focal. Theories of attention and salience therefore introduce another layer between perception and judgment. Their common problem is selective orientation, but the term *salience* changes meaning across psychology and economics. A careful genealogy must preserve those differences.

William James offered one of the canonical psychological formulations of attention. In *The Principles of Psychology*, attention concerns the mind's taking possession of one among several simultaneously possible objects or trains of thought (James 1890). His treatment links attention to selection, interest, habit, voluntary effort, and the practical impossibility of attending equally to everything. The importance of this account is not a timeless theory of cognitive selection. It is the recognition that experience is organized through selective emphasis and that what occupies focal awareness is partly dependent on prior interests and acquired habits.

Later uses of salience often formalize a more specific mechanism. In behavioral economics, Bordalo, Gennaioli, and Shleifer develop a salience theory of choice under risk in which attention is drawn toward payoff states whose attributes stand out relative to alternatives, and this differential salience affects decision weights (Bordalo et al. 2012). Their model is not a general philosophy of appearance, nor does it imply that all socially salient objects obey the same mechanism. Its relevance to this genealogy lies in showing that selective prominence can be incorporated into formal accounts of economic choice rather than treated as an incidental psychological disturbance around an otherwise complete representation of alternatives.

The difference between James and contemporary salience theory is theoretically productive. James's account is broad, psychological, and closely connected to interest and habit. The economic model is narrower and specifies how comparative contrast can alter the weighting of choice-relevant states. Neither alone explains public visibility, cultural attention, or aesthetic salience. Together they show that selection can occur at several levels: what enters focal awareness, which features dominate comparison, and which alternatives become practically decision-relevant.

Institutions and technologies can participate in each level. A market interface can order goods by price, popularity, sponsorship, or predicted relevance. A news system

can repeatedly foreground one class of events. A scientific visualization can amplify a pattern that is difficult to detect in raw observations. An administrative category can render one form of deprivation measurable while leaving another dispersed across incompatible records. These examples extend beyond the theories cited above, but they make clear why attention cannot be treated only as an internal property of an isolated decision maker. Environments can be organized to solicit, stabilize, or redirect attention.

This is one point at which the AI era gives the older genealogy renewed importance. Search, recommendation, ranking, summarization, and generative systems increasingly intervene before conscious human selection. They can expand the range of accessible material while also pre-ordering that material according to learned or institutionally chosen criteria. The conceptual issue is prior to any normative conclusion about whether this is beneficial or harmful. Classical attention theory and modern salience theory already establish that selection matters; contemporary AI makes the organization of that selection increasingly explicit as an object of inquiry.

For later GR development, the main inheritance is therefore not a single definition of salience. It is a layered problem: perceptual availability does not guarantee attention, attention does not guarantee importance, and importance can be shaped by comparison structures, habits, institutions, and technical mediation. These distinctions become necessary once inquiry turns to how curiosity, aesthetic attraction, economic choice, or political recognition emerge from a field containing far more possible objects than any subject can engage at once.

#### 2.4.4 Recognition and Visibility

Attention concerns selection among available objects, whereas recognition introduces an explicitly social relation. To recognize another person is not merely to detect that person's physical presence. Recognition theories examine how persons become socially acknowledged in ways connected to standing, identity, respect, or participation. This adds a normative and institutional dimension to the genealogy of appearance.

Honneth's discussion of invisibility is especially useful because it distinguishes perceptual visibility from social recognition. A person can be seen in the ordinary sensory sense while being treated as socially nonexistent or unworthy of acknowledgement. Honneth reconstructs invisibility as a failure of recognition rather than a failure of visual registration (Honneth 2001). The distinction clarifies why increased informational visibility does not automatically produce social presence. Individuals can be counted, tracked, classified, or represented in administrative systems while remaining unrecognized in the practices through which social standing is expressed.

Arendt's political account of appearance offers a different but complementary problem. Public action takes place in a space of appearance constituted among plural persons; the actor becomes manifest through words and deeds whose meaning is inseparable from the presence and responses of others (Arendt 1958). Arendt is not developing recognition theory in Honneth's later sense. Her account nevertheless emphasizes that human appearance is relational and worldly. The possibility of appearing as an actor depends on a public realm, and the consequences of action



unfold through relations that no individual controls completely.

The two lineages should therefore remain separate. Honneth concerns recognition and its denial; Arendt concerns plurality, action, and public appearance. Their convergence is limited but significant: social visibility cannot be reduced to physical observability. Institutions, practices, and other persons participate in whether someone appears as a participant, claimant, author, citizen, worker, expert, or member of a common world.

Economic analysis supplies many situations in which this distinction matters. Unpaid care can be indispensable to social reproduction while remaining weakly visible in conventional economic accounting. Informal workers can be materially active yet lack categories through which their claims become institutionally legible. A community can appear in a dataset only after an administrative classification is created. Platform workers can be intensely measurable in operational terms while having little standing in the governance of the systems that evaluate them. These examples do not all instantiate the same theory of recognition. They illustrate why perceptual, statistical, institutional, and normative visibility should not be conflated.

The distinction is particularly important under expanding digital mediation. Being visible to a machine can mean being identifiable, classifiable, rankable, or predictable. Being visible to a market can mean becoming a target of pricing or recommendation. Being visible in public can mean something else again: possessing the conditions to speak, be heard, make claims, and affect shared interpretation. The traditions reconstructed here therefore caution against measuring human appearance simply by the quantity of information available about a person.

For later GRE, this provides an important conceptual resource. Economic relations do not merely distribute material goods; they also participate in the production of categories, positions, and channels through which subjects and activities become visible or invisible. Yet that claim belongs to later substantive analysis. At the level of foundations, recognition theory and political theories of appearance establish that visibility has multiple forms and that social visibility is itself relationally constituted.

### 2.4.5 Relational Conditions of Appearance

The traditions reviewed in this section can now be compared without being synthesized into a single doctrine. Phenomenology treats appearance and perception through embodied, situated experience. Ecological psychology emphasizes relations between organismic capacities and environmental affordances. Classical psychology analyzes attention as selective orientation. Behavioral economics formalizes one mechanism through which comparative salience can alter choice. Recognition theory distinguishes sensory visibility from social acknowledgement. Political philosophy examines the public conditions under which persons appear to one another through action and speech. These are different research programmes addressing different objects.

Their limited convergence concerns the inadequacy of an unmediated picture of appearance. Across these traditions, what becomes available to a subject depends on conditions: bodily orientation, environmental structure, habit, interest, comparison, public institutions, social recognition, and technologies of mediation. None of these



conditions is sufficient by itself. Their relevance varies with the kind of appearance under investigation.

This convergence provides one condition of possibility for a later generative relational treatment. GR can ask how the conditions of appearance are themselves formed, stabilized, altered, and transmitted through relations. Such a question goes beyond the theories reconstructed here, but it does not begin from nothing. Phenomenology already makes situated access central; ecological psychology makes organism–environment fit central; attention research makes selection central; recognition theory makes social acknowledgement relational; political theories of appearance make public presence dependent on plurality and worldly institutions. GR inherits a problem-space in which access is already conditioned.

A further possibility follows once these conditions are regarded historically. What enables a phenomenon to appear in a particular encounter can precede that encounter without being timeless. A perceptual habit can be learned; a category can be institutionalized; a canon can be formed; a technical interface can be redesigned; a vocabulary of recognition can emerge historically. The conditions of appearance can therefore have their own trajectories. Later GR sections will ask more explicitly how conditions of generation can themselves be generated. At this point, the intellectual genealogy establishes only that such recursive inquiry is philosophically and theoretically intelligible.

This is also where the existential question raised by contemporary AI can be located without turning the present section into a theory of AI. If human experience is partly constituted through what can appear, interrupt expectation, solicit attention, and become recognizable as significant, then systems that increasingly mediate encounter participate in conditions historically associated with human orientation to a world. Existing theories of perception and attention do not by themselves determine what human existence requires under AI mediation. They do show why the issue cannot be reduced to whether an artificial system supplies correct information. The organization of appearance and encounter is itself theoretically significant.

The section therefore leaves GR with a carefully delimited inheritance. Appearance is not identical with reality; perception is situated; attention is selective; salience is structured; recognition exceeds detection; and public visibility depends on social conditions. These distinctions prepare the following inquiry into aesthetics. Aesthetic experience presupposes that something has appeared with enough force, form, or significance to solicit judgment, yet the traditions of aesthetics ask a further question: how does an encountered object, relation, event, or form come to be experienced and judged as beautiful, harmonious, sublime, strange, elegant, or otherwise aesthetically significant?

## **2.5 Aesthetics and Aesthetic Judgment**

The preceding section reconstructed theories of appearance, perception, attention, salience, and recognition as conditions under which something can become available for judgment. The present section turns to a distinct but connected lineage: philosophical, sociological, psychological, and scientific accounts of aesthetic experi-

ence and aesthetic judgment. Its purpose is not to supply a new GR theory of beauty at this stage of the book. It is to recover several ways in which existing traditions have explained how beauty, harmony, elegance, sublimity, strangeness, surprise, and taste become intelligible. These traditions differ substantially. Hume emphasizes cultivated judgment and comparison; Kant analyzes judgments of beauty and sublimity through a critical philosophy of judgment; Dewey locates aesthetic experience within transactions between organism and environment; Bourdieu reconstructs taste through social position and cultural competence; empirical aesthetics investigates processing, appraisal, expertise, and the stages through which aesthetic responses develop; and philosophy of science examines the role of aesthetic criteria in theory choice. The section proceeds through these lineages before identifying the limited conceptual space they make available for later GR development, especially the historical formation of aesthetic judgment, its relation to contingency, and its possible coupling with epistemic and normative judgment.

### 2.5.1 Beauty and Aesthetic Experience

Modern aesthetics contains a persistent tension between two questions. One asks what makes an object beautiful or aesthetically valuable. The other asks what occurs in a subject or community when something is experienced and judged aesthetically. Theories differ according to how they distribute explanatory weight among properties of the object, capacities of the perceiver, practices of judgment, social formation, and historically available standards.

Hume's essay on the standard of taste is an important early statement of this problem. Hume begins from the evident diversity of taste while resisting the conclusion that every aesthetic judgment has equal standing. Practice, comparison, freedom from prejudice, delicacy of sentiment, and the joint verdict of qualified judges play a central role in his account (Hume 1985). The theory does not reduce beauty to a simple property located independently in objects, yet neither does it make judgment wholly arbitrary. Aesthetic competence is cultivated through repeated encounter and comparison.

Kant gives aesthetic judgment a different philosophical structure. In the *Critique of Judgment*, judgments of beauty are connected to disinterested pleasure and to a claim to a form of universal communicability that is not grounded in a determinate concept of the object (Kant 1987). The judgment of taste therefore occupies a distinctive position between merely private liking and concept-governed cognition. Kant's account is central to later aesthetics precisely because it attempts to explain how aesthetic judgment can be subjective in its basis while nevertheless making a demand that reaches beyond idiosyncratic preference.

Dewey's *Art as Experience* shifts attention from isolated judgments toward the organization of experience. Aesthetic experience is treated in continuity with interactions between organism and environment, becoming distinctive through the consummatory integration of doing and undergoing rather than through separation from ordinary life (Dewey 1934). Dewey's position differs sharply from Kant's transcendental project, but it adds a resource that later relational theories find especially important: aesthetic significance can be analyzed through temporally organized experience and

interaction rather than only through an isolated object–subject pair.

These three lineages already prevent a simple definition of beauty. Hume directs attention to cultivated capacities of comparison; Kant to the form and communicability of aesthetic judgment; Dewey to the organization of experience across interaction and time. Their disagreements remain substantial. They nonetheless make available several components that later GR can inherit without conflating them: judgment has conditions, those conditions can involve practice and comparison, aesthetic experience unfolds within an encounter, and aesthetic significance cannot be reduced without remainder to instrumental utility.

This last point is important for the place of aesthetics in the genealogy of GRE. Economic analysis often treats preference as given for the purpose of a model. Aesthetics reminds us that valuation can also involve experiences whose significance is not exhausted by possession, exchange, or expected utility. The question of how such evaluative capacities arise belongs to later sections. Here, the philosophical lineage establishes that aesthetic judgment has long been treated as a distinctive form of orientation whose standards, communicability, and cultivation require explanation.

### 2.5.2 Harmony, Elegance, and Form

Aesthetic discourse frequently uses terms such as harmony, proportion, order, simplicity, unity, and elegance. Their recurrence can create the impression that they name timeless and self-evident properties. Existing theories instead show that these terms acquire meaning within practices of perception, comparison, criticism, and disciplinary evaluation.

Kant's analysis of beauty gives form an important role without reducing beauty to the possession of a fixed geometrical property. His account of purposiveness without a determinate purpose concerns the way form can be judged as if organized purposively for our cognitive faculties even when no concept supplies the purpose that would determine the judgment (Kant 1987). Whatever later uses of harmony or elegance retain from Kant, they cannot therefore be represented simply as measurements of objective regularity.

Hume's emphasis on practice and comparison offers another way to understand why judgments of form can become discriminating. The experienced critic does not merely possess stronger feelings than the novice. Repeated exposure, comparison among works, and the cultivation of perceptual discrimination alter the capacity to notice relations that would otherwise remain coarse or undifferentiated (Hume 1985). Harmony and elegance can accordingly function as vocabularies through which trained perceivers articulate organized relations they have learned to distinguish.

Empirical aesthetics provides more specific hypotheses. Reber, Schwarz, and Winkielman propose processing fluency as one contributor to aesthetic pleasure, arguing that features that facilitate perceptual or conceptual processing can produce positive affect that may be attributed to the stimulus (Reber et al. 2004). The fluency account is not a general theory of beauty. Its importance lies in demonstrating how an apparently immediate aesthetic response can be studied through mechanisms relating properties of a stimulus to processing conditions in a perceiver. The same

formal property need not yield the same experience when expertise, expectation, familiarity, or context changes.

The multi-stage model proposed by Leder and colleagues offers a broader psychological framework for visual aesthetic appreciation. It distinguishes stages involving perceptual analysis, implicit memory integration, explicit classification, cognitive mastering, and evaluation, while allowing expertise and context to affect the process (Leder et al. 2004). The model is substantially different from philosophical theories of taste or judgment. Its contribution to the genealogy is methodological: aesthetic appreciation can be decomposed into interacting processes rather than treated as an unanalyzable immediate response.

The language of elegance also has an important life outside art. Scientists and mathematicians often use aesthetic predicates when evaluating theories, proofs, equations, or representations. McAllister's *Beauty and Revolution in Science* examines the historical role of aesthetic preferences in scientific theory appraisal and argues that the weight attached to aesthetic properties can change through the history of successful theories (McAllister 1996). This literature is especially important for the later discussion of curiosity and epistemic orientation because it shows that aesthetic judgment can participate in knowledge practices without becoming identical with evidential confirmation.

The resulting lesson is not that harmony and elegance are merely subjective or merely social. Existing theories distribute their explanation differently among form, perceptual processing, expertise, comparison, and historical disciplinary practice. For GR, the importance of this plurality is foundational: what is experienced as organized or elegant may depend on relations between encountered structure and a historically formed capacity for discrimination. That formulation remains a bridge rather than a completed GR theory.

### 2.5.3 Sublimity, Strangeness, and Surprise

Aesthetics is not confined to experiences of easy harmony. Traditions of the sublime, theories of interest, and empirical work on aesthetic emotion show that difficulty, vastness, novelty, incongruity, and partial resistance to comprehension can themselves become aesthetically significant. This broadens the genealogy beyond accounts in which positive aesthetic response follows only from smooth fit between object and expectation.

Kant's analysis of the sublime provides a classical philosophical example. The sublime concerns experiences in which imagination confronts magnitude or power that exceeds its ordinary capacity for sensible presentation, while reason supplies another dimension through which the subject relates to that inadequacy (Kant 1987). The sublime is therefore structurally different from the beautiful in Kant's account. It makes aesthetic experience possible through tension and limit rather than through the harmonious form characteristic of judgments of beauty.

Dewey likewise allows aesthetic experience to include resistance, tension, and transformation. An experience acquires unity through the temporal organization of doing and undergoing; difficulty can become part of a consummatory experience when tensions are developed and resolved rather than merely eliminated in advance

(Dewey 1934). This makes aesthetic significance compatible with encounter, struggle, and temporal development.

Empirical work on interest offers another vocabulary. Silvia's appraisal account relates interest in visual art to appraisals of novelty–complexity and coping potential (Silvia 2005). Something can attract interest because it is new, complex, unfamiliar, or initially difficult, provided that the perceiver also has some possibility of making sense of it. This framework is useful because it explains why neither pure familiarity nor pure incomprehensibility necessarily maximizes aesthetic engagement. Interest can arise in a region where expectation is disturbed without the object becoming wholly inaccessible.

The distinction is significant for the role of contingency in the present book. Aesthetic experience need not be generated only by objects already predicted to fit established criteria. Unexpected encounters can reorganize attention because they disclose a relation, form, or possibility that was not included in the subject's prior anticipations. The philosophical and psychological traditions cited here explain this in different ways: through sublimity, temporal tension, appraisal of novelty, or the relation between complexity and coping. None supplies a general theory of contingency. Together they make it intelligible that surprise and partial resistance can contribute positively to aesthetic experience.

This point will later matter for inquiry. A mathematical conjecture, empirical anomaly, unfamiliar cultural form, or unexpected theoretical connection can be experienced as beautiful or compelling before its epistemic value has been established. The aesthetic response can orient further attention without functioning as evidence that the proposition is true. Existing scientific practice makes this distinction especially important: elegance can motivate investigation, while proof, evidence, and explanatory adequacy remain separate requirements.

The AI era adds a new context to an old issue. Generative systems can produce vast numbers of objects that conform to learned regularities and can also produce unfamiliar combinations. Existing theories of fluency, surprise, expertise, and interest suggest that aesthetic significance cannot be inferred simply from novelty or from conformity to preference. The relation between expectation and encounter remains theoretically important. This observation is a contemporary application of the lineage rather than an independent aesthetic theory.

#### **2.5.4 Aesthetic Judgment and Selective Attention**

Aesthetic judgment does more than register a response after an object has already received sustained attention. It can participate in the organization of future attention by determining what is revisited, compared, preserved, taught, imitated, criticized, or used as a standard. Existing theories provide several ways to understand this feedback without treating aesthetic judgment as a single psychological mechanism.

Hume's account already contains a temporal structure of this kind. Practice and comparison improve judgment, while improved judgment changes how later works are perceived and compared (Hume 1985). Aesthetic competence is therefore cumulative. The critic's present response carries the effects of earlier encounters, and each new encounter can refine the repertoire through which subsequent works are appre-

hended.

Leder and colleagues give a psychological model in which prior knowledge, expertise, classification, and cognitive mastering affect aesthetic evaluation (Leder et al. 2004). The implication is not that judgments are completely determined by training. Rather, what can be discriminated and how an object is processed depend partly on acquired repertoires. Expertise can redirect attention toward formal relations that remain unavailable to a novice, while a surprising work can require revision of previously adequate classifications.

Bourdieu places this learning within a much wider social structure. In *Distinction*, taste is connected to class position, habitus, cultural capital, and socially differentiated competencies (Bourdieu 1984). Aesthetic judgment is therefore implicated in practices of social classification and distinction. Bourdieu's analysis challenges accounts that treat taste as a purely private response detached from education, social trajectory, and access to legitimate culture. It also raises a question that more psychological models do not answer on their own: who acquires the opportunities and competencies required for particular forms of aesthetic discrimination?

McAllister's account of scientific aesthetics provides a disciplinary analogue. If scientific communities come to associate certain aesthetic properties with historically successful theories, those associations can influence which later theories attract attention and initial confidence (McAllister 1996). Scientific aesthetics thereby shows how judgments can become selective devices inside organized inquiry. The process is neither purely individual nor infallible. Aesthetic criteria can guide attention productively and can also become conservative when inherited standards favor forms associated with prior success.

These lineages together support a distinction that will become important for GRE. Aesthetic judgment can orient attention without determining epistemic or normative validity. What appears elegant may deserve examination but can be false. What appears harmonious may be unjust. What appears strange may be epistemically fertile or merely unfamiliar. Aesthetic selection therefore belongs to the conditions of inquiry and valuation without replacing the standards internal to those other domains.

Technological systems increasingly enter this selective process. Recommendation systems, cultural platforms, rankings, and generative models can amplify some aesthetic regularities while reducing exposure to others. The theoretical importance of this mediation follows from older accounts rather than superseding them: if taste develops through exposure, comparison, expertise, and social classification, then the infrastructures that organize exposure become part of the historical environment in which taste is formed. This point prepares the final subsection's discussion of historical and relational formation.

### 2.5.5 Historical and Relational Formation of Aesthetic Judgment

The strongest contribution of the preceding traditions to the intellectual possibility of GR lies in their shared refusal, for different reasons, to treat aesthetic judgment as an isolated instantaneous preference without history. Hume gives judgment a history of practice and comparison. Dewey places aesthetic experience within temporal transactions between organism and environment. Bourdieu reconstructs taste through



social trajectory, habitus, cultural competence, and institutions. Empirical aesthetics treats expertise, memory, classification, and appraisal as conditions of response. McAllister shows how aesthetic criteria in science can acquire historically changing weights. These theories do not amount to one account of aesthetic formation, but each makes some form of antecedent conditioning theoretically legitimate.

This allows the apparent paradox of aesthetic emergence to be stated more carefully. A particular experience of beauty can be genuinely new for a subject even though capacities that make the experience possible already exist. Prior comparison, perceptual training, inherited vocabularies, embodied habits, institutional canons, expectations, and technical media can precede the local judgment. Their antecedence does not require them to be timeless. Bourdieu's sociology and McAllister's historical account make especially clear that standards which appear immediate at one moment can themselves have histories (Bourdieu 1984; McAllister 1996).

For GR, this opens a recursive question that the existing literature does not need to have formulated in GR's terms. If the conditions enabling judgment are historically produced, later judgments can also participate in altering those conditions. A work enters a canon; a style becomes teachable; a scientific representation becomes exemplary; a community learns to discriminate a previously unfamiliar form; a new medium changes what can be encountered and compared. The local event of judgment and the historical formation of the conditions of judgment can therefore be investigated at different temporal scales. This is a preliminary GR translation of resources supplied by earlier theories, not a claim that those theories are equivalent to GR.

A second possibility concerns the relation between aesthetic and normative judgment. The traditions surveyed here give strong reasons to keep them analytically distinct. Kant's aesthetic judgment does not establish moral rightness; Bourdieu's sociology shows that socially legitimate taste can participate in hierarchy rather than moral justification; scientific elegance does not prove a theory. Yet historical practice also shows that aesthetic and normative orders can become entangled. Institutions determine what is preserved, displayed, taught, protected, censored, monumentalized, or funded, and those decisions alter the field in which aesthetic sensibilities develop. Aesthetic attachments can in turn influence what communities come to regard as worthy of preservation, dignity, reverence, or collective identification.

GR can later describe this relation in terms of coupling and co-evolution while preserving non-equivalence. Normative judgment can reshape the conditions under which aesthetic judgment develops; aesthetic judgment can influence the formation and persistence of normative orientations. The direction and strength of coupling can change historically. Such a formulation should be treated as a research programme rather than a completed theory. It requires empirical work on institutions, education, cultural transmission, media, and power, as well as philosophical work on the distinct standards appropriate to each domain.

The existential concern raised by AI belongs here in the same restrained way. If aesthetic judgment is formed through encounter, comparison, surprise, cultivated discrimination, and historical participation, then a world of abundant machine-generated objects changes more than the quantity of available cultural material. It can change the conditions under which encounters occur and the routes through

which sensibilities are formed. Yet existing aesthetics does not support a simple conclusion that machine generation either destroys or secures human aesthetic existence. The more defensible question concerns participation: how human beings continue to encounter contingency, become affected, judge, revise their standards, remember prior encounters, and contribute to the future conditions under which significance can emerge.

This question connects aesthetics to the broader issue of human existence without resolving it here. The possibility that an encounter with an unanticipated relation can matter to a person's sense of existing in a world will be developed later through phenomenology and theories of subjectivity. The present section supplies only the aesthetic foundation. Aesthetic experience can involve being addressed by something not fully contained in prior expectation, while aesthetic judgment can transform the subject's later orientation toward what deserves attention.

Chapter 2 therefore does not yet need a finished GR aesthetics. Its task is to establish why such an aesthetics can be formulated. Hume provides the cultivation and comparison of taste; Kant the distinctive structure of aesthetic judgment and the beautiful–sublime distinction; Dewey the temporal and transactional organization of experience; Bourdieu the social formation of taste; empirical aesthetics the mechanisms of processing, appraisal, and expertise; and philosophy of science the historical operation of aesthetic criteria in inquiry. From these heterogeneous foundations, GR can later ask how aesthetic capacities and standards emerge, how they become self-reinforcing or transformable, how they couple with normative and epistemic orders, and how encounters with contingency participate in the formation of human orientation. The next section follows the final connection directly by turning from aesthetic significance to curiosity, the formation of questions, and the selection of what becomes worth knowing.

## **2.6 Curiosity, Inquiry, and Epistemic Orientation**

The preceding sections established that what becomes available for judgment is shaped by conditions of appearance, perception, salience, and aesthetic discrimination. The present section turns from what attracts or organizes attention to the further question of how attention becomes inquiry. Its role in the intellectual genealogy is to reconstruct traditions that have treated wonder, curiosity, problem formation, epistemic interest, and research selection as conditions of knowledge production rather than as incidental psychological preliminaries. The discussion is deliberately plural. Classical philosophy connects wonder with the beginning of inquiry; pragmatism locates inquiry in doubt and problematic situations; psychology studies curiosity as a response to novelty, uncertainty, and perceived knowledge gaps; educational theory examines the development of sustained interest; formal epistemology gives questions an explicit place in inquiry; and the history and sociology of science show that communities do not investigate every possible problem. These traditions differ in object, scale, and method, and they should not be treated as interchangeable. Together, however, they make one foundational point available for later GR development: knowledge generation depends not only on the quality of answers but also on the historically and relationally structured formation of

what becomes worth asking, pursuing, and preserving. The section proceeds from wonder and curiosity, through question formation and epistemic orientation, to non-instrumental inquiry and the institutional selection of what becomes known.

### 2.6.1 Wonder and Curiosity

Wonder occupies an old place in philosophical accounts of inquiry. In Plato's *Theaetetus*, Socrates associates wonder with the beginning of philosophy, while Aristotle's *Metaphysics* similarly presents wonder and perplexity as conditions from which philosophical questioning develops (Plato 1921; Aristotle 2016). These passages do not amount to a modern psychology of curiosity. Their significance is genealogical. They identify a disturbance in an existing orientation toward the world—an experience in which something is no longer simply taken for granted—as a possible beginning of inquiry.

The classical connection between wonder and ignorance is especially important. Aristotle does not describe inquiry as the mechanical accumulation of additional information. Wonder arises because something presents itself as puzzling and thereby discloses a limitation in what is understood. The movement from obvious perplexities toward larger questions gives inquiry a direction: ignorance becomes partially determinate because the inquirer encounters something whose explanation is missing. The unknown is therefore not merely an undifferentiated absence of knowledge. It can acquire form through an experienced discrepancy, anomaly, surprise, or incompleteness.

Pragmatist traditions later give this transition a more explicit account. Peirce's *The Fixation of Belief* treats inquiry as a response to genuine doubt rather than to the merely grammatical production of questions. His insistence on a “real and living doubt” distinguishes the existence of an interrogative sentence from the existence of an inquiry that matters to the inquirer (Charles S. Peirce 1877). A person can utter a question without being unsettled by it, just as a discipline can contain formally open problems that attract little actual attention. Inquiry begins when an unsettled condition has sufficient force to orient further activity.

Dewey develops a related but broader account of reflective thought. In *How We Think*, curiosity, perplexity, suggestion, observation, and inference belong to the cultivation of reflective inquiry rather than to separate mental compartments (Dewey 1910). For Dewey, a problematic or doubtful situation does not automatically determine a solution. It must be clarified, interpreted, and transformed through inquiry. This approach is valuable for the present genealogy because it connects curiosity to habits of investigation and to education. Curiosity can be supported, disciplined, redirected, or suppressed by the environments in which thinking occurs.

Twentieth-century psychology shifts the scale of analysis. Berlyne's work treats curiosity and exploratory behavior in relation to properties such as novelty, complexity, uncertainty, and conflict (Berlyne 1954). This research does not reproduce the classical concept of wonder. It asks instead which stimulus conditions elicit exploratory orientation and how curiosity can be studied experimentally. The shift is theoretically important: a phenomenon that philosophy had often discussed as an existential or intellectual beginning becomes available for psychological differentiation

and measurement.

Loewenstein's information-gap account gives curiosity another influential formulation. Curiosity can arise when a person becomes aware of a gap between what is known and what one wants to know, creating a deprivation-like motivation to obtain the missing information (Loewenstein 1994). This account helps explain why curiosity is often strongest neither under complete knowledge nor under total ignorance. A gap must in some sense become represented. If a person has no conception that relevant information exists, there may be no experienced gap to close. Curiosity therefore depends partly on the relation between present knowledge and an intelligible possibility of further knowledge.

Subsequent work complicates any single-gap model. Litman, Hutchins, and Russon distinguish patterns of epistemic curiosity associated with feeling-of-knowing, uncertainty, exploratory behavior, and different affective orientations toward missing information (Litman et al. 2005). Their results support the broader conclusion that curiosity is not a unitary response to ignorance. Some forms are connected to tension and deprivation; others involve positive interest in exploration. The theoretical implication for this chapter is modest but important: the movement toward knowledge can be motivated by different configurations of uncertainty, anticipated understanding, affect, and prior knowledge.

These lineages also clarify the relation between curiosity and the aesthetic phenomena examined in Section 2.5. Surprise, strangeness, complexity, and elegance can attract attention without necessarily generating inquiry, while curiosity can arise in cases that lack strong aesthetic experience. Psychological and philosophical traditions nevertheless provide reasons to expect interaction. An unexpected pattern can first become salient, then interesting, then puzzling, and finally an object of sustained inquiry. The transitions are contingent rather than automatic. Salience, aesthetic attraction, curiosity, epistemic interest, and justified belief therefore remain analytically distinct even when they occur in a connected sequence.

For later GR work, the most useful inheritance from this literature is not a universal definition of curiosity. It is the recognition that inquiry can have a prehistory. Something must become capable of disturbing, attracting, or orienting an inquirer before a formal research process begins. Classical wonder, pragmatist doubt, experimental curiosity, and information-gap theories offer different accounts of this prehistory. Their differences should be preserved because they identify different mechanisms and scales at which an orientation toward the unknown can emerge.

## 2.6.2 Formation of Questions

A theory of inquiry remains incomplete if it begins only after a question has already been given. The formation of questions concerns how an indeterminate concern becomes articulated as a problem, how boundaries are placed around what is unknown, and how some interrogative forms become actionable while others remain diffuse. Several intellectual traditions have approached this issue from different directions, ranging from pragmatist accounts of problematization to formal logics of questions and empirical studies of problem finding.

Peirce's distinction between real doubt and merely verbal questioning provides

an early constraint. The presence of a question mark does not itself establish inquiry (Charles S. Peirce 1877). This point shifts attention from grammatical form to the conditions that make a question epistemically operative. A genuine question must arise within some background of belief, expectation, uncertainty, or practice. Its force depends on what is at stake in resolving it and on what kinds of answers could count as resolving the doubt.

Dewey's account of reflective thought places greater emphasis on the transformation of an initially confused difficulty into a defined problem. A problematic situation is not yet a well-formed research question. Inquiry requires work that determines what the difficulty consists in, which observations matter, and what possible explanations or courses of investigation deserve consideration (Dewey 1910). This makes problem definition part of inquiry rather than a neutral preliminary supplied from outside. The quality of investigation can therefore depend on the quality of problem formation.

Creativity research gives this distinction an empirical form. Getzels and Csikszentmihalyi's longitudinal study of artists made *problem finding* a central object of analysis, distinguishing creative work in which the problem must be discovered or formulated from tasks in which a well-defined problem is simply assigned (Getzels and Csikszentmihalyi 1976). Their study concerns artistic production rather than scientific inquiry in general, so its conclusions should not be universalized. Its broader contribution is to make visible a stage that solution-centered models often suppress: selecting, constructing, or reframing the problem can itself be part of creative achievement.

The logic of questions approaches the same broad issue from a very different direction. Hintikka's interrogative model treats inquiry through sequences of questions and answers, including questions addressed to nature through observation and experiment (Hintikka 1999). Here the question is not primarily a psychological event or a creative disposition. It has a logical and strategic role in the growth of knowledge. Different questions can open different paths through an inquiry, and strategies of questioning matter for what information can be obtained.

The contrast among these traditions is instructive. Dewey emphasizes the reconstruction of problematic situations; Getzels and Csikszentmihalyi emphasize problem finding in creative practice; Hintikka formalizes inquiry as an interrogative process. None can substitute for the others. A formal logic of questions does not by itself explain why a particular question becomes salient to a historical community. A psychological account of problem finding does not determine the logical conditions of answerability. A pragmatist account of problematic situations does not provide a complete sociology of research agendas. Their conjunction nevertheless establishes that questions have structure, histories, and conditions of formation.

Question formation also depends on available concepts. A community cannot easily ask a question for which it lacks any discriminating vocabulary, measurement practice, or representational form. New concepts can therefore create new interrogative possibilities. The emergence of a category may turn previously dispersed experiences into a recognizable problem; a new instrument may make a difference measurable; a new archive may permit a previously inaccessible historical question; a new mathematical representation may allow a relation to be posed with greater precision. This claim does not require that language completely determine thought. It

requires only the weaker conclusion that the resources of inquiry affect which questions can be stably formulated and communicated.

Institutional settings add another condition. Research questions are formed within disciplines, professions, schools, laboratories, funding systems, legal categories, and political conflicts. The same phenomenon can be posed differently depending on whether it is approached as a scientific anomaly, a policy problem, a legal injury, an economic inefficiency, an ethical concern, or an aesthetic disturbance. Different question forms direct attention toward different objects and standards of relevance. Question formation is therefore already partly a process of framing.

This is one place where the transition toward GR can be made visible without replacing the reviewed theories. A later generative-relational account may ask about the histories and relations through which questions themselves become possible: which encounters supplied the anomaly, which concepts made it nameable, which institutions sustained attention, which prior judgments made it valuable, and which exclusions left alternative questions unformed. Chapter 2 does not yet need to answer those questions. Its task is to establish that major traditions already give strong reasons not to treat questions as costless, context-free inputs into a knowledge-producing machine.

### 2.6.3 Epistemic Interest and Orientation

Curiosity can be episodic, while inquiry often requires persistence. The concept of epistemic orientation concerns the more durable ways in which persons and communities become disposed toward certain objects, problems, methods, or forms of understanding. The relevant literatures again operate at different scales. Psychology and education study the development of interest; critical theory examines connections between knowledge and human interests; philosophies of inquiry analyze the aims that organize investigation. These approaches should not be merged into one concept merely because they share the word *interest*.

Hidi and Renninger's four-phase model of interest development is useful precisely because it distinguishes transient attraction from more stable orientation. Their model differentiates triggered situational interest, maintained situational interest, emerging individual interest, and well-developed individual interest (Hidi and Renninger 2006). The account is educational and psychological rather than philosophical, but it supplies an important temporal insight: what begins as a momentary attraction can, under appropriate conditions, become a durable pattern of re-engagement and knowledge seeking.

This developmental perspective complicates the idea that research preferences are simply given. Repeated encounters, opportunities for re-engagement, growing knowledge, social support, and perceived value can help stabilize an interest. Conversely, the absence of opportunity or recognition can prevent a potentially significant curiosity from developing into a sustained orientation. An epistemic trajectory therefore depends partly on environments that allow a question to return, deepen, and accumulate connections.

Loewenstein's information-gap theory and Litman's work on epistemic curiosity help clarify another dimension. Interest in knowing depends on how ignorance is



represented relative to existing knowledge (Loewenstein 1994; Litman et al. 2005). An expert and a novice can encounter the same phenomenon while experiencing different gaps. Expertise can reduce some forms of uncertainty while generating more refined questions in their place. Increased knowledge therefore need not monotonically reduce curiosity. It can reorganize the space of what becomes intelligibly unknown.

Critical theory treats epistemic orientation at a more structural level. Habermas's *Knowledge and Human Interests* argues that inquiry can be related to knowledge-constitutive interests and criticizes views that isolate knowledge from the conditions and purposes of human activity (Habermas 1971). This vocabulary should not be equated with psychological curiosity. Habermasian *interests* concern the constitution and orientation of forms of knowledge at a level different from individual motivational states. The relevance here is that epistemic activity can have systematic orientations that are not reducible to isolated preferences for information.

Longino's social epistemology adds another distinct lineage. Scientific knowledge is produced through communities whose critical interactions, background assumptions, and social organization affect the evaluation of evidence and claims (Longino 1990). This approach directs attention from individual motivation toward the social conditions under which inquiry becomes epistemically productive. The orientation of a research community is shaped not only by what individual members find interesting but also by standards of criticism, accessible evidence, disciplinary training, and the distribution of authority.

The concept of orientation can therefore be used here in a deliberately broad but non-equivalent sense. At the psychological level, it concerns relatively durable patterns of interest and re-engagement. At the philosophical level, it concerns aims and standards that organize inquiry. At the social level, it concerns disciplinary and institutional arrangements that make some objects recurrently available for investigation. These levels can interact without being collapsed.

Aesthetic judgment can participate in this interaction. Section 2.5 showed that elegance, strangeness, harmony, or surprise can influence selective attention without determining truth. In mathematics and science, an aesthetically compelling conjecture, proof strategy, model, or pattern can become a durable object of epistemic interest. In other domains, moral shock, political urgency, personal experience, or institutional responsibility can generate the relevant orientation instead. Inquiry therefore has multiple routes of motivational and evaluative formation.

This point is particularly important for later discussion of AI. If computational systems make answers, summaries, candidate hypotheses, and formal derivations increasingly abundant, epistemic orientation does not thereby become irrelevant. The capacity to remain with a problem, to recognize which uncertainty deserves sustained attention, and to revise one's orientation through encounter may become more visible as a distinct component of knowledge work. Chapter 2 should state this only as a contemporary implication of the reviewed traditions. The psychological development of interest, the critical-theoretical analysis of knowledge interests, and the social organization of inquiry already show that knowing has an orientational dimension before any GR account is added.

### 2.6.4 Inquiry beyond Instrumental Utility

Not all inquiry is undertaken because its practical payoff is known in advance. The genealogy of curiosity repeatedly contains a tension between inquiry directed toward an identifiable external end and inquiry pursued because knowing, understanding, or resolving a perplexity is itself experienced as worthwhile. This distinction matters for economics because a narrow model of inquiry as investment toward predictable utility can miss forms of knowledge generation whose future significance is indeterminate at the time of pursuit.

Aristotle provides a classical statement of this distinction. In Book I of the *Metaphysics*, the movement from wonder toward knowledge is connected to inquiry pursued for the sake of knowing rather than solely for practical utility (Aristotle 2016). The historical and metaphysical framework is far removed from modern science policy, yet the distinction survives: knowledge can be valued independently of a presently specified application.

Veblen gives the issue an especially relevant place within social and economic thought. In *The Instinct of Workmanship and the State of the Industrial Arts*, he discusses an “idle curiosity” through which human beings seek knowledge without an ordinarily utilitarian aim, while also observing that knowledge obtained in this manner can later become useful for technology and workmanship (Veblen 1914). The formulation is valuable because it separates the motivation of inquiry from the eventual uses of its results. Knowledge can acquire instrumental value without having been generated under an instrumental objective.

Pragmatism complicates any simple opposition between intrinsic and practical inquiry. Peirce treats inquiry as the effort to move from doubt toward belief, while Dewey situates reflective thinking within problematic situations and practices (Charles S. Peirce 1877; Dewey 1910). Neither view requires that every inquiry be justified by an externally priced outcome. Practical involvement can generate questions whose resolution expands understanding beyond immediate application. Conversely, apparently abstract inquiry can alter later practices in ways that were not predictable at the outset.

The distinction is therefore better understood in terms of orientation than in terms of a rigid separation between “useful” and “useless” knowledge. Inquiry can be strongly application-directed, weakly application-directed, exploratory, curiosity-driven, or directed toward understanding whose future relevance remains open. A field that supports only questions with demonstrable short-run utility may systematically exclude forms of exploration whose value cannot yet be articulated in the categories used for evaluation.

This problem appears within research policy as a difficulty of temporal evaluation. The benefits of an inquiry may be delayed, indirect, distributed across domains, or dependent on later developments. A mathematical structure developed without foreseeable application can later become foundational to technology; an archival inquiry can alter legal or historical understanding; an observational anomaly can matter only after another theory makes it intelligible. The possibility of later use does not retroactively make the original inquiry instrumentally motivated.

The same point applies to individual learning. Curiosity may lead a person into

subjects that have no immediate role in a planned career or task. Those encounters can nevertheless reorganize later capacities, analogies, judgments, and possible questions. Educational environments that preserve exploratory inquiry therefore do more than provide leisure around a utilitarian core. They can enlarge the repertoire from which later understanding is generated.

None of these arguments establishes that inquiry should be insulated from questions of social cost, responsibility, or public priority. Resources are finite, and some investigations impose risks or opportunity costs. The point is narrower: instrumental justification is one mode of epistemic valuation rather than an exhaustive account of why inquiry begins or why it may deserve support. Classical philosophy, institutional economics, pragmatism, and educational theory all provide resources for preserving this distinction.

For GR, this leaves an important but later problem. If knowledge can emerge from encounters whose future value is unknown, then a generative account of inquiry must be able to represent option value, unforeseeable recombination, and the transformation of evaluative criteria over time without simply declaring all curiosity valuable. Such questions belong to the later substantive and methodological development of GRE. Chapter 2 establishes only the intellectual basis for taking them seriously.

### 2.6.5 Knowledge Generation and the Selection of What to Know

The final step in this genealogy concerns selection. No individual, discipline, institution, or society can investigate every possible question. Knowledge production therefore always takes place against a much larger background of questions that remain unasked, unfunded, unmeasured, unpublished, or forgotten. Theories of curiosity explain why some unknowns attract persons; theories of question formation explain how problems become articulable; theories of epistemic orientation explain how interests become durable. The history and sociology of science add the collective question of how research agendas are structured.

Kuhn's account of normal science makes problem selection part of disciplinary organization. Paradigms do not merely provide answers; they also define legitimate problems, exemplars, methods, and standards through which scientific work proceeds (Kuhn 1962). Normal science is productive partly because inquiry is constrained. Researchers need not reopen every foundational issue before solving a disciplinary puzzle. Yet the same structure means that what counts as a significant problem is historically organized rather than determined by the universe of all logically possible questions.

Longino's social epistemology similarly emphasizes the communal conditions under which evidence and criticism become effective (Longino 1990). A research community allocates attention through publication venues, standards of relevance, disciplinary training, reputational structures, and access to criticism. These arrangements can improve knowledge production by concentrating expertise and enabling distributed scrutiny. They can also create exclusions or blind spots when background assumptions remain insulated from effective challenge.

The sociology of "undone science" makes the negative side of selection especially visible. Frickel and colleagues use the concept to analyze research that is identified

as socially valuable yet remains unfunded, incomplete, or ignored, including cases in which social movements and civil-society actors contest established research agendas (Frickel et al. 2010). The concept is important because ignorance is not always merely the temporary residue left after finite investigators do as much research as possible. Patterns of non-knowledge can be socially organized.

This observation extends the problem of epistemic orientation from individuals to institutions. Funding priorities, commercial incentives, measurement infrastructures, ethical restrictions, state classifications, publication norms, and available datasets influence what can become a stable object of knowledge. A question requiring a costly instrument may remain marginal despite intellectual importance. A phenomenon not represented in administrative categories can remain statistically invisible. A socially stigmatized population can be understudied. A commercially valuable problem can attract disproportionate attention. These are not all failures; selection is unavoidable. They show, however, that knowledge has an agenda structure.

The selection of what to know also has a historical dimension. Questions can disappear when archives are destroyed, languages are lost, practices become inaccessible, or communities capable of interpreting records no longer exist. Conversely, new instruments, digitization, legal access, conceptual innovation, or political change can reopen questions that earlier periods could not answer. The space of inquiry therefore changes with the resources available to later observers.

This historical variability connects the present section to the epistemic revisability established in Section 2.3. Revisability concerns not only the possibility that an answer will change. The questions themselves can change. Later investigators may reconstruct an earlier problem differently, discover that previously ignored evidence matters, or recognize that the categories under which a question was posed were inadequate. Inquiry has histories of re-questioning as well as histories of correction.

The AI era makes this selection problem unusually visible. Generative and retrieval systems can reduce the cost of producing candidate answers, summaries, classifications, code, proofs, and hypotheses. This does not remove scarcity from inquiry. Scarcity can move toward attention, validation, problem selection, data access, experimental opportunity, and the human or institutional capacity to decide what deserves sustained investigation. If millions of plausible research directions can be generated cheaply, the epistemic significance of choosing among them becomes greater rather than smaller.

The older literatures provide several reasons to resist a simple delegation model. Peirce distinguishes living doubt from merely verbal questions. Dewey treats problem definition as part of reflective inquiry. Getzels and Csikszentmihalyi make problem finding visible as a component of creative work. Hidi and Renninger show that sustained interest develops through histories of engagement. Kuhn and Frickel and colleagues show that communities organize research agendas and omissions. None of these theories was written to analyze contemporary generative AI, and they should not be retrofitted into one anticipatory theory. Together, however, they imply that a system capable of answering questions is not thereby equivalent to a process capable of generating the human, social, and historical conditions under which questions acquire significance.

This distinction bears on the existential concern that will be developed more directly in the following section. Human participation in knowledge generation may involve more than originating text or solving a predefined problem. It can include encountering contingency, becoming puzzled, learning to care about an uncertainty, forming a question, sustaining an interest, revising the question through inquiry, and allowing the resulting knowledge to transform subsequent orientation. The point is not to reserve these capacities metaphysically for humans. It is to identify a sequence of phenomena that existing philosophies and sciences of inquiry already treat as significant and that cannot be reduced to answer production alone.

A restrained GR synthesis can now be stated. The traditions reviewed in this section make it plausible to investigate the *generative history of epistemic orientation*: how encounters, prior knowledge, aesthetic and normative judgments, conceptual resources, institutions, technologies, and social relations participate in producing the questions that later organize inquiry. They also make it possible to ask how successful inquiries feed back into future orientation by changing what can be perceived, named, valued, and questioned. This is a research direction rather than a result established by the present genealogy. GR's contribution, if developed successfully, would lie in tracing relations among these levels without claiming that classical wonder, psychological curiosity, pragmatist inquiry, critical-theoretical interest, and institutional research agendas are instances of one already unified mechanism.

The chapter's immediate purpose is therefore foundational. Existing traditions already show that knowledge has antecedent conditions of selection. What becomes known depends partly on what can appear as puzzling, what can be formulated as a question, what can sustain interest, what institutions will support, and what communities regard as worth investigating. The next section turns to phenomenology, subjectivity, and existence, where the relation between inquiry and the lived experience of being situated in a world can be examined more directly.

## 2.7 Phenomenology, Subjectivity, and Existence

The preceding sections reconstructed traditions concerned with appearance, aesthetic judgment, curiosity, and the formation of inquiry. The present section turns to the philosophical lineages that made lived experience, subjectivity, embodiment, situatedness, finitude, and existence into explicit objects of analysis. Its role in the chapter is foundational rather than doctrinal. Phenomenology and existential philosophy supply several of the conceptual conditions through which later relational and generative approaches can ask how subjects inhabit worlds, encounter others, form projects, and experience their own existence without reducing those questions to an isolated mental interior. The discussion proceeds through five related movements: lived experience; the subject–world relation; embodiment and situatedness; meaning, finitude, and existential orientation; and relational accounts of encounter and otherness. These lineages overlap historically, but they do not constitute a single theory. Husserlian transcendental phenomenology, Heideggerian fundamental ontology, Merleau-Pontian embodiment, Sartrean and Beauvoirian existentialism, Schutzian social phenomenology, Buberian dialogue, and Levinasian ethics differ substantially in method, ontology, and normative implication. Their importance for

the present genealogy lies in the conceptual problems they make available. Together they establish that subjectivity can be studied through modes of appearing, practical involvement, embodiment, temporal projection, social situation, and relation, thereby opening a space in which later GR work can examine the historical and relational formation of subjective continuity while retaining ontological suspension.

### 2.7.1 Lived Experience

Phenomenology gave twentieth-century philosophy a disciplined vocabulary for treating experience as an object of inquiry without reducing experience either to an inventory of private sensations or to a third-person causal description. Husserl's project is central to this lineage. In *Ideas*, phenomenological reduction suspends the ordinary commitment to the independently existing world in order to investigate how objects, meanings, and relations are given in experience (Husserl 2012). The methodological emphasis falls on intentionality: consciousness is directed toward something, and the structure of that directedness becomes available for analysis. The phenomenological object is therefore not an inward mental item detached from the world. It is the experienced relation in which something is presented under a particular mode of givenness.

This move changes the status of lived experience in philosophical inquiry. Experience becomes analytically structured. Perceiving, remembering, imagining, anticipating, valuing, and judging are distinguishable intentional acts with different temporal and evidential profiles. An object can also be given through multiple perspectives without being exhausted by any single presentation. The importance of this framework for later social and economic inquiry is methodological: the way a phenomenon is experienced can matter even where the same phenomenon admits a different physical, statistical, institutional, or legal description. A wage, debt, workplace, price, institution, or technological system may have objective characteristics while also entering lived experience through fear, familiarity, expectation, obligation, possibility, or indifference. Phenomenology supplies conceptual resources for keeping those modes of access analytically visible.

Husserl's later account of the lifeworld expands this problem. In *The Crisis of European Sciences and Transcendental Phenomenology*, scientific idealization is traced back to a pretheoretical world of experience, practice, language, and inherited meaning that scientific abstraction presupposes (Husserl 1970). The lifeworld is not simply a collection of subjective impressions. It is the historically sedimented horizon within which objects, practices, and scientific questions already have intelligibility. Scientific concepts can emerge from this world and subsequently transform it. The relation between everyday experience and formal knowledge is therefore historically recursive: abstraction depends on a world of practice and meaning, while successful abstractions can later reorganize how that world is understood and inhabited.

This later Husserlian movement is especially relevant to the architecture of the present chapter. Sections 2.3–2.6 have already distinguished observation, salience, aesthetic judgment, curiosity, and inquiry. The lifeworld tradition adds a further condition. The subject who observes or inquires is already situated within inherited practices of relevance, language, expectation, and embodied familiarity. The appear-



ance of a problem therefore takes place within a world that has been partially organized before explicit reflection begins. Phenomenology makes this background available for philosophical analysis without requiring that every background condition be made fully explicit.

Schutz carries these questions into the social sciences. His *Phenomenology of the Social World* attempts to clarify the subjective meaning of action and the structures through which actors understand one another in everyday life (Schutz 1967). Schutz's project is particularly important for an economic genealogy because it places phenomenological analysis in direct conversation with Weberian social science. Social actors do not encounter an unclassified social field. They rely on typifications, stocks of knowledge, expectations of relevance, and practical understandings of what others are doing. Social-scientific constructs are therefore built upon a world in which actors have already constituted situations as meaningful.

Schutz also marks a transition from transcendental problems of constitution toward intersubjective social reality. Everyday social life ordinarily presupposes the existence of others and the possibility of mutual understanding. The analyst can reconstruct these structures without claiming transparent access to another person's inner life. This point is methodologically significant. Subjective meaning can be real and causally consequential even when it is accessible only through interpretation, action, language, institutional context, and patterns of mutual orientation. A theory of lived experience therefore need not collapse into introspection, and a theory of social structure need not erase the experiential standpoint of actors.

The phenomenological inheritance is consequently plural. Husserl provides a method for analyzing modes of givenness and intentional structure; the lifeworld concept places scientific abstraction within a historically inherited experiential horizon; Schutz extends these resources toward the intersubjective organization of social meaning. None of these positions by itself supplies a complete account of social subjectivity. Together they establish a foundational proposition for the genealogy: lived experience has structure, history, and social conditions, and those dimensions can matter for explanation even where they are not reducible to externally observable variables.

### 2.7.2 Subject and World

Existential phenomenology transforms the relation between subjectivity and world by challenging the image of a self-contained subject that first exists and subsequently encounters an external environment. Heidegger's *Being and Time* is decisive in this shift. Heidegger analyzes Dasein through the unitary structure of being-in-the-world, within which self, world, practical involvement, and relations with others are internally connected dimensions of existence (Heidegger 1962). The world in this framework is not primarily a container filled with neutral objects. It is a meaningful context of practices, equipment, roles, purposes, and possibilities in which entities matter through forms of involvement.

This analysis changes the philosophical status of practical engagement. Ordinary activity is not treated as an epistemically inferior layer that must be reconstructed from detached cognition. Much of everyday intelligibility is already practical. A

tool is encountered through what can be done with it, a room through possibilities of movement and use, and an institution through roles, expectations, and shared practices. The meaningful world is therefore disclosed through involvement before it is converted into an object of theoretical description. Heidegger's vocabulary of readiness-to-hand, concern, and being-with provides one influential account of this pre-reflective intelligibility (Heidegger 1962).

The concept of being-with also prevents being-in-the-world from becoming an individualistic theory of practical absorption. Others are implicated in the intelligibility of equipment, norms, tasks, and social possibilities. A workplace, market, household, school, or public institution is encountered through practices whose meanings have already been socially organized. Heidegger's analysis remains distinct from sociological explanation, yet it supplies an important philosophical resource: the world in which a subject acts is already a shared world, and the subject's possibilities are intelligible through historically available modes of conduct.

Merleau-Ponty develops another route beyond a detached subject-object relation. In *Phenomenology of Perception*, perception is situated within a phenomenal field organized through bodily orientation, figure and ground, habit, movement, and practical familiarity (Merleau-Ponty 2012). Subject and world appear as correlates within an embodied perceptual relation. The perceiver does not stand outside the world as a spectator assembling representations from atomic sensory inputs. Perception takes place from somewhere, through a body with capacities, habits, and a practical orientation toward its surroundings.

The difference between Heidegger and Merleau-Ponty should remain visible. Heidegger's analysis is organized around the question of being and the existential structure of Dasein, while Merleau-Ponty gives more sustained attention to perception, bodily motility, habit, and the phenomenal field. Both, however, weaken the plausibility of an account in which a fully constituted subject and a fully constituted world are related only after each has been independently specified. Their work makes subjectivity analyzable through modes of involvement that are already worldly.

Sartre radicalizes a different dimension of this problem. In *Being and Nothingness*, consciousness is analyzed through intentionality, facticity, transcendence, project, and situation (Sartre 1956). A situation contains conditions that the subject has not chosen, yet those conditions acquire significance within projects and possibilities. Sartre's account gives a particularly strong role to freedom and projection. The subject is not exhausted by its given characteristics because it continually relates itself to possibilities that exceed what is presently actual.

The Sartrean emphasis on projection introduces a tension that becomes important in later existential thought. If situation acquires meaning through projects, the subject can appear to carry an unusually strong burden of meaning-constitution. Merleau-Ponty gives greater weight to pre-reflective bodily structure, while Beauvoir later develops a more explicitly social and material account of situated freedom. The theoretical differences matter. They show that moving beyond a detached subject does not settle how freedom, constraint, embodiment, social structure, and meaning should be distributed within an account of subjectivity.

For the present genealogy, the principal inheritance is a change in the unit of philo-

sophical attention. Subjectivity can be approached through a subject–world relation in which practical contexts, possibilities, others, embodiment, and inherited meanings are already operative. This makes later relational inquiry conceptually possible without establishing that all subjectivity is reducible to social relation. The foundational point is weaker and more useful: theories of the subject need not begin from an isolated bearer of internal states, and theories of the world need not begin from a neutral inventory of objects whose significance is added only afterward.

### 2.7.3 Embodiment and Situatedness

Embodiment gives existential phenomenology one of its most durable critiques of abstract subjectivity. Merleau-Ponty's account of the lived body treats bodily existence as the medium through which space, objects, other persons, and practical possibilities become accessible (Merleau-Ponty 2012). The body is experienced differently from an ordinary external object. It is continuously implicated in perception and action, possesses habitual capacities, and organizes a field of possible movement before explicit deliberation occurs. Embodiment therefore concerns more than the physical location of a mind. It concerns the pre-reflective organization of what a subject can perceive, reach, avoid, endure, learn, and do.

Merleau-Ponty's distinction between the present body and the sedimented habit body is especially important for a genealogy concerned with historical formation. Repeated activity can become incorporated into bodily capacities so that earlier learning remains operative without requiring continuous reflective reconstruction. Skill, posture, orientation, and practical familiarity exemplify forms of history carried in embodied conduct. The body thereby provides a model of continuity in which the past persists through transformed capacities rather than through explicit memory alone. This idea will later become relevant to social and institutional theories of habit, practice, and subject formation, although those theories should not be treated as simple extensions of phenomenology.

Sartre also distinguishes the lived body from the body apprehended as an object, but his analysis connects embodiment closely to facticity and the presence of others (Sartre 1956). The body is part of the given situation through which freedom is exercised, while the other's look reveals the subject's capacity to appear as an object in another perspective. This produces a distinctive analysis of interpersonal vulnerability. A subject experiences itself both through its own projects and through the possibility of being apprehended, classified, or fixed by others. Sartre's treatment of conflict in relations with others differs from dialogical or recognition-centered theories, yet it establishes an enduring problem: subjectivity includes exposure to perspectives that the subject does not control.

Beauvoir develops situatedness in a direction that gives greater weight to reciprocal freedom, material conditions, social hierarchy, and historical constraint. In *The Ethics of Ambiguity*, human existence is characterized by ambiguity: persons are finite and situated while also projecting beyond given conditions through freedom and action (Beauvoir 1948). Freedom is lived within circumstances that include other freedoms, institutions, material limitations, and political arrangements. The existence of possibility therefore depends partly on conditions that can support or obstruct the

capacity to undertake projects.

This Beauvoirian move is significant because it prevents existential freedom from being treated as independent of social structure. Situatedness contains more than a descriptive fact about occupying a position in space and history. Different situations distribute vulnerability, resources, recognition, and practical possibility unevenly. The subject can transcend aspects of a situation only through capacities and relations that are themselves conditioned. Beauvoir's account does not eliminate freedom into structure; it treats freedom as something lived through concrete conditions and in relation with others.

The combined lineage also changes the status of the body in social and economic analysis. A laboring, consuming, caregiving, migrating, learning, or aging subject is embodied. Fatigue, pain, mobility, sensory access, dependency, skill, and bodily vulnerability can shape what options are practically available even where an abstract model assigns identical formal choices. Phenomenology does not by itself provide an economic theory of these differences. It supplies a reason to distinguish formally represented possibility from lived possibility and to recognize that action is mediated by capacities that are bodily and historically acquired.

Situatedness also complicates the idea of a universal observer. Section 2.3 treated perspective as an epistemic condition; existential phenomenology adds that perspectives are lived from embodied and socially located positions. A standpoint has temporal depth, practical stakes, and differential exposure to the consequences of action. This insight can support later methodological pluralism without turning every claim into an expression of position. Situated knowledge still admits criticism, comparison, evidence, and revision. Its contribution is to make the conditions of access part of the analysis rather than treating them as automatically irrelevant.

For later GR development, embodiment and situatedness supply conceptual resources for asking how subjective capacities are formed and sustained across time. That question remains open at this stage. The literature reviewed here establishes that subjectivity is enacted through bodies, habits, situations, and possibilities, and that these dimensions can preserve traces of prior relations. It does not yet determine which relations are necessary or sufficient for subjective continuity, nor whether interpersonal recognition is the only relation capable of sustaining such continuity. Those are later generative questions that require a broader comparative analysis.

#### **2.7.4 Meaning, Finitude, and Existential Orientation**

Existential philosophy adds temporality and finitude to the analysis of subjectivity. Heidegger's account of care describes Dasein through an interconnected structure of thrownness, projection, and involvement in a present world (Heidegger 1962). A subject inherits conditions it did not choose, exists among already available practices and meanings, and projects itself toward possibilities that are not yet actual. Existence therefore has a temporal organization. The past persists through factual conditions, the future enters the present through possibilities and projects, and current action is structured by both.

Finitude gives this temporal organization existential significance. Heidegger's analysis of being-toward-death treats mortality as a limit on the field of possibility

rather than merely as a biological event awaiting occurrence (Heidegger 1962). Because possibilities cannot all be realized, choosing and committing acquire weight. Finitude makes orientation selective. A life unfolds through paths taken and foregone, projects continued and abandoned, relations maintained and lost. This does not provide a substantive criterion for which projects deserve commitment. It explains why commitment, temporality, and the limitation of possibility become central to the structure of existence.

Sartre approaches existential orientation through facticity and transcendence. Existing conditions are given, while consciousness projects possible ways of acting and being beyond them (Sartre 1956). Meaning is therefore connected to projects. A situation becomes significant through what a subject is doing, attempting, avoiding, or becoming. Sartre's concept of bad faith analyzes forms of self-relation in which subjects attempt to evade the tension between given conditions and freedom by treating themselves as wholly fixed or wholly unconstrained. The account is philosophically demanding because it attributes strong responsibility to the subject for the meaning of its situation.

Beauvoir preserves the importance of projection while placing greater emphasis on ambiguity, reciprocity, and the conditions of freedom (Beauvoir 1948). Human beings are simultaneously factual and transcendent, finite and open to projects, subjects of their own activity and objects within the worlds of others. Meaningful action therefore unfolds without guarantees of complete control or final reconciliation. Projects extend into a world inhabited by other freedoms, and the future remains open to consequences that exceed the actor's intention.

This existential emphasis on contingency and open futurity provides a useful continuation of the preceding sections on aesthetic judgment and curiosity. An encounter can matter because a subject is temporally oriented and because the world can disclose possibilities that were not already integrated into an established project. Surprise, wonder, anxiety, beauty, loss, and conflict can reorganize what a person experiences as significant. Existential philosophy supplies several different accounts of such reorientation. Heidegger emphasizes moods and disclosedness, Sartre projects and choice, Beauvoir ambiguity and concrete freedom, while Merleau-Ponty gives greater weight to embodied perception and sedimented habit. Their differences prevent the category of existential orientation from becoming a single mechanism.

The problem of meaning should also be separated from the claim that meaning is merely a private act of subjective assignment. Heidegger's being-in-the-world locates intelligibility in shared practices; Merleau-Ponty locates perception within an embodied field; Beauvoir places freedom among other freedoms and material conditions; Schutz analyzes socially available stocks of knowledge and typification. These lineages all weaken a picture in which an isolated individual creates meaning from an otherwise entirely neutral world. Meaning can be experienced personally while depending on inherited languages, practices, bodies, institutions, and relations.

This point is relevant to contemporary conditions of technological mediation, including artificial intelligence, without making AI the organizing framework of the section. If systems increasingly generate text, images, recommendations, analyses, and possible courses of action, the existential problem is not exhausted by whether the generated output is correct or useful. Older phenomenological and existential tra-



ditions direct attention toward how a person inhabits possibilities, encounters contingency, forms commitments, and experiences the significance of acting within a finite life. The contemporary question can therefore concern participation in meaning formation as well as access to generated representations. Chapter 2 does not resolve that question; it identifies the intellectual resources through which the question becomes philosophically intelligible.

For later GR work, the most relevant inheritance is the temporal and situated character of existential orientation. Subjects do not merely occupy states. They carry histories, project possibilities, revise commitments, and remain exposed to events that can reorganize what matters. A generative account may later ask how relations participate in the formation, stabilization, disruption, and renewal of these orientations. At this stage, the genealogy establishes the prior conceptual terrain: existence is temporally extended, finite, situated, and oriented toward possibilities whose meaning can change.

### 2.7.5 Relation and the Witnessing of Existence

The relation between subjectivity and otherness becomes explicit in phenomenological, dialogical, and ethical traditions that refuse to treat the other merely as another object within a subject's world. These traditions differ substantially in their accounts of intersubjectivity. Their common relevance lies in making encounter itself philosophically significant. The phrase *witnessing of existence* is used here as a provisional label for a later GR problem: the ways in which an existence can become manifest, encountered, acknowledged, or sustained within relations. It is not presented as a standard term shared by the thinkers reconstructed below.

Husserl's phenomenology makes intersubjectivity indispensable to the constitution of an objective and shared world, while Schutz relocates the problem within the everyday social world (Husserl 1970; Schutz 1967). Schutz is especially important because mutual orientation does not require direct possession of another person's consciousness. Actors encounter one another through bodily presence, action, language, typification, temporal coordination, and shared situations. Social understanding is therefore partial and structured. The other can be experienced as another subject without becoming fully transparent.

Buber gives relation a different philosophical status. *I and Thou* distinguishes I–Thou relation from I–It relation and places encounter, presence, and the “between” at the center of dialogical philosophy (Buber 1970). The distinction is not a technical taxonomy of all social relations. It articulates different modes of relating. In an I–It orientation, the other is approached through objectification, use, description, or classification. In I–Thou encounter, the other is addressed as a presence that exceeds reduction to an object of manipulation. Buber also extends the possibility of I–Thou relation beyond interpersonal human interaction to encounters with nature and the divine, although the character of reciprocity differs across these domains.

Buber's contribution is useful for the present genealogy because it places the constitution of the “I” within relational language. The self that says “I” in I–Thou is not identical to the self that says “I” in I–It. Relation therefore affects the mode in which selfhood is enacted. This claim should not be translated directly into GR terminology. Bu-



ber's dialogical philosophy carries theological, existential, and ethical commitments that differ from the ontological suspension of the present project. Its importance lies in demonstrating that a theory of subjectivity can treat relation as formative of the mode of selfhood rather than as an external connection between already complete individuals.

Levinas develops an even more asymmetrical account of relation. In *Totality and Infinity*, the encounter with the other is organized through exteriority, face-to-face relation, and responsibility (Levinas 1969). The other resists complete incorporation into the categories through which the self comprehends the world. Relation therefore includes a limit on appropriation. The other's alterity matters precisely because it cannot be exhausted by the subject's representation of it. Levinas's account gives this irreducibility an ethical priority that Buber does not formulate in the same way.

The contrast between Buber and Levinas is theoretically productive. Buber emphasizes dialogue, mutuality, and the between; Levinas emphasizes asymmetry, exteriority, and responsibility. Schutz approaches intersubjectivity through everyday social meaning, while Husserl approaches it through problems of constitution and objectivity. None of these can be treated as interchangeable formulations of relational subjectivity. Their disagreement reveals several distinct dimensions that later theories must keep apart: mutual recognition, dialogical presence, interpretive access, ethical responsibility, non-assimilability, and the shared conditions through which subjects inhabit a world together.

These traditions also complicate the assumption that subjective continuity depends exclusively on continuous interpersonal recognition. Buber's extension of dialogical relation beyond human-human encounter and phenomenology's emphasis on world-involvement suggest a broader field of possible relations through which existence can acquire continuity and significance (Buber 1970; Merleau-Ponty 2012). A mathematician may sustain a life through long involvement with mathematical objects and problems; a religious practitioner may orient existence through relations to sacred beings, practices, or traditions; a person may experience continuity through sustained relations with landscapes, artworks, crafts, institutions, or nonhuman life. These examples do not establish that interpersonal relations are dispensable. They show why the question of which relational configurations sustain subjective continuity cannot be settled by definition alone.

The preceding point also connects carefully to the problem of contingency developed in Sections 2.5 and 2.6. An encounter can witness existence by interrupting habitual orientation and disclosing that a subject is affected by something that was not wholly produced by its prior plan. Aesthetic experience, curiosity, dialogue, loss, resistance, and unexpected recognition can each reveal this structure in different ways. The philosophical lineages reconstructed here provide conceptual resources for understanding why such encounters can matter, but they do not justify collapsing them into one universal existential mechanism.

Artificial intelligence makes this inherited problem newly visible without creating it. Increasingly mediated relations may support human agency, enlarge access to meaningful objects, and create new forms of encounter; they may also organize interaction around prediction, personalization, functional substitution, or rapid answer production. Phenomenology, existentialism, dialogical philosophy, and theories of

otherness together suggest that the relevant evaluation cannot concern output quality alone. It can also concern whether forms of mediation preserve or transform the conditions under which subjects encounter otherness, exercise situated judgment, form commitments, and experience themselves as participants in a world whose meanings are not exhausted in advance.

For later GR development, these traditions open a research problem rather than deliver a settled solution. A generative-relational account of subjectivity may investigate how different relations participate in producing, stabilizing, or transforming subjective continuity; how relations with persons, institutions, practices, objects, environments, and artificial systems differ in their generative consequences; and how aesthetic, epistemic, ethical, and existential orientations can become coupled over time. Chapter 2 retains these as questions made possible by prior theory. The conceptual achievement of the present genealogy is to show why subjectivity can be investigated through lived experience, world-involvement, embodiment, situation, finitude, encounter, and otherness without presupposing that any one of those dimensions provides a complete ontology of the subject.

## 2.8 Hermeneutics, Language, and Interpretation

The preceding section reconstructed phenomenological and existential traditions concerned with lived experience, subjectivity, embodiment, situation, and encounter. The present section turns to the lineages through which understanding, interpretation, language, symbolic mediation, and historical meaning became explicit philosophical problems. Its role in the chapter is genealogical. Hermeneutics, philosophy of language, structural linguistics, symbolic-form theory, and ordinary-language philosophy offer different accounts of how human beings understand texts, actions, institutions, signs, and worlds whose significance is neither simply given in sensation nor exhausted by formal description. The discussion proceeds through five movements: interpretation and understanding; language and symbolic mediation; historicity and interpretive horizons; interpretive systems and the formation of syntax; and meaning as relational and historical formation. These traditions should not be collapsed into a single theory. Schleiermacher's general hermeneutics, Dilthey's methodology of the human sciences, Heidegger's hermeneutic phenomenology, Gadamer's philosophical hermeneutics, Ricoeur's hermeneutics of text and action, Saussurean structural linguistics, Cassirer's philosophy of symbolic forms, Wittgenstein's account of language-games and rule-following, and Austin's speech-act analysis differ in object, method, ontology, and normative implication. Their relevance to the present genealogy lies in showing why meaning must be treated as mediated, situated, interpretable, and historically revisable before later GR work asks how interpretive relations themselves are generated, stabilized, and transformed.

### 2.8.1 Interpretation and Understanding

Modern hermeneutics develops from practices of textual interpretation into a more general philosophical problem concerning how understanding is possible. Schleiermacher occupies a decisive place in this expansion. His *Hermeneutics and Criticism*

treats interpretation as a general task rather than a technique reserved for obscure passages or sacred texts. Understanding requires attention both to language as a shared system and to the particular use of language by an individual speaker or author (Schleiermacher 1998). The interpreter moves between grammatical and what Schleiermacher calls psychological or technical dimensions of interpretation: expressions belong to a language whose structures exceed any individual utterance, while an utterance also bears the marks of a particular act of composition. Interpretation therefore already involves a relation between part and whole, rule and use, inherited language and singular expression.

This account is important because it prevents understanding from being represented as simple extraction of a self-contained meaning. A sentence is intelligible through the language to which it belongs; the language is encountered through particular sentences and uses. Likewise, a passage can be interpreted through its place within a work, while an interpretation of the work depends on the passages through which it is available. What later scholarship calls the hermeneutic circle is therefore not merely a procedural inconvenience. It identifies a recursive structure of understanding in which local and larger contexts illuminate one another.

Dilthey extends hermeneutics from textual interpretation toward the epistemology and methodology of the human sciences. Historical and social life is available through what he calls objectifications or expressions of life: actions, institutions, texts, artworks, gestures, and other publicly available formations through which lived experience becomes interpretable (Dilthey 1996). Understanding is consequently neither direct access to another person's interiority nor a purely external causal account. The interpreter encounters outward expressions and reconstructs the meaningful nexus in which they belong. Dilthey's later hermeneutics thus connects interpretation with historical inquiry and with the possibility of disciplined understanding across differences of time, culture, and individual experience.

Dilthey's distinction between the natural and human sciences is sometimes summarized too sharply as explanation opposed to understanding. His mature work is more complicated. Explanation and understanding can interact, and historical inquiry can employ causal, comparative, and interpretive procedures together. What remains distinctive is the object of inquiry: human action and historical formations are meaningful, and their intelligibility cannot be exhausted by treating them solely as externally observable events (Dilthey 1996). This point becomes foundational for later social theory. Institutions, markets, laws, organizations, and economic practices can have material consequences while also depending on categories, conventions, expectations, and interpretations that actors use to orient action.

Heidegger changes the status of hermeneutics more radically. In *Being and Time*, interpretation is no longer introduced primarily as a method for recovering the meaning of texts or historical expressions. It belongs to the structure of being-in-the-world itself (Heidegger 1962). Understanding is practical and projective before it becomes an explicit act of interpretation. A person already inhabits possibilities, roles, equipmental contexts, and shared practices through which things matter in determinate ways. Explicit interpretation articulates an intelligibility that is already operative in practical involvement.

This ontological turn has two consequences for the genealogy. First, it weakens

the image of an interpreter who stands outside an object and subsequently assigns meaning to it. Interpretation proceeds from prior involvement. Second, it makes pre-understanding philosophically unavoidable. Inquiry begins from inherited concepts, expectations, concerns, and possibilities rather than from a neutral standpoint. The problem then becomes how such prior structures can be made visible, revised, or transformed without imagining that interpretation could ever begin from no horizon at all.

Gadamer develops this problem into philosophical hermeneutics. In *Truth and Method*, understanding is treated as an event situated within language, tradition, and historically formed horizons rather than as the mechanical application of an interpretive method (Gadamer 2004). Gadamer's rehabilitation of prejudice does not mean that inherited judgments are necessarily correct. It identifies prejudgments as conditions through which a subject initially encounters a question or text. Interpretation can expose these prejudgments to challenge. Understanding is therefore possible because the interpreter brings a horizon to the encounter, while the encounter can alter that horizon.

Ricoeur preserves the centrality of interpretation while resisting any simple opposition between hermeneutics and explanation. His essays collected in *From Text to Action* develop a hermeneutics in which texts acquire a degree of autonomy from the intentions and immediate situations of their authors, making explanation an important part of interpretation (Ricoeur 1991). Structural analysis, semantic clarification, and other explanatory procedures can help disclose what a text makes available for understanding. Ricoeur's movement from text toward action also widens hermeneutics beyond literary objects. Meaningful action can be interpreted because action can become detached from the immediacy of its occurrence, leave traces, enter institutions, and become available for later redescriptions.

Across these traditions, interpretation changes philosophical status several times. For Schleiermacher, it becomes a general discipline of understanding discourse. For Dilthey, it grounds inquiry into historical expressions of life. For Heidegger, understanding belongs to being-in-the-world. Gadamer emphasizes the historical event of understanding, while Ricoeur connects interpretation with textual distance, explanation, and action. Their disagreements matter. The traditions do not justify the claim that every phenomenon is merely a text, nor do they imply that causal explanation is dispensable. They establish a narrower and more durable foundation: when human phenomena depend upon meaning, understanding them requires attention to the conditions under which meaning is articulated, inherited, contested, and revised.

## 2.8.2 Language and Symbolic Mediation

Hermeneutics becomes inseparable from a broader problem of linguistic and symbolic mediation when language is no longer treated as a transparent vehicle for independently completed thoughts. Several twentieth-century traditions reach this result through very different arguments. Structural linguistics, symbolic-form theory, later Wittgensteinian philosophy, speech-act theory, and philosophical hermeneutics all deny, in distinct ways, that language can be understood merely as a set of labels attached to an already fully articulated world.

Saussure's *Course in General Linguistics* provides one influential structural account. The linguistic sign is analyzed through the relation between signifier and signified, while linguistic value depends on differences within a system rather than on an intrinsic bond between a word and an independently isolated concept (Saussure 1966). The consequence is methodological as well as linguistic. An element acquires value through relations of contrast and combination with other elements. Meaning cannot therefore be inferred from a sign considered entirely by itself. Saussure also distinguishes synchronic analysis of a language system from diachronic analysis of linguistic change, providing an influential vocabulary for separating the organization of a system at a given moment from the historical processes through which that organization changes.

Structural linguistics does not by itself provide a theory of interpretation. Its importance for the present genealogy lies in making relational differentiation central to signification. A monetary term, occupational category, legal status, economic indicator, or institutional label can likewise acquire practical meaning partly through its position within a classificatory field. The analogy must be used cautiously: social categories are not simply linguistic signs, and their material consequences cannot be reduced to semiotic difference. Saussure nevertheless supplies a conceptual resource for recognizing that meaning can depend on structured relations among terms rather than on isolated correspondence.

Cassirer's philosophy of symbolic forms broadens mediation beyond ordinary language. In the first volume of *The Philosophy of Symbolic Forms*, language belongs to a larger field of symbolic activity through which human experience is articulated and given objective form (Cassirer 1955). Myth, religion, art, language, and science represent different symbolic formations rather than imperfect versions of one universal representational scheme. Human access to a world is therefore symbolically organized. The world encountered through scientific concepts is not articulated in the same manner as the world encountered through mythic, artistic, or everyday linguistic forms.

Cassirer's position is particularly useful for distinguishing symbolic mediation from simple verbal mediation. Economic life is organized through currencies, numbers, accounting categories, legal forms, diagrams, models, rankings, narratives, contracts, and institutional classifications as well as through ordinary speech. Such symbolic formations can make objects comparable, action possible, and institutions intelligible. They can also exclude or obscure phenomena that do not fit their modes of articulation. Cassirer's project does not amount to a contemporary sociology of classification, but it supplies an earlier philosophical foundation for treating symbolic form as constitutive of intelligibility rather than as a passive after-image of reality.

The later Wittgenstein reaches a different account of meaning through attention to use. *Philosophical Investigations* criticizes the temptation to search for one essence of language or one hidden object that every meaningful expression names. Language is instead approached through heterogeneous language-games embedded within forms of life (Wittgenstein 2009). Asking, ordering, reporting, joking, calculating, promising, thanking, describing, and hypothesizing are activities in which words acquire roles through use. Meaning is consequently inseparable from practices in which standards



of correct and incorrect continuation are learned and sustained.

Wittgenstein's reflections on rule-following are important here because they complicate a picture in which syntax or meaning is determined once and for all by an abstract rule independent of practice. A rule does not contain all of its future applications in a manner that eliminates judgment. Rules are followed within practices in which examples, correction, training, agreement, and customary continuation make action intelligible (Wittgenstein 2009). This does not imply that meaning is arbitrary at each moment. It locates stability in publicly learnable practices rather than in a private mental association or an entirely self-applying formal object.

Austin's speech-act theory makes another dimension of linguistic mediation explicit. *How to Do Things with Words* shows that utterances can perform actions under conventional and situational conditions: promising, naming, warning, apologizing, declaring, and other acts are accomplished through language rather than merely described by it (Austin 1962). Linguistic meaning therefore has an institutional and practical dimension. The effect of saying something can depend on recognized procedures, speaker positions, uptake, context, and conventions. This is especially relevant to law and economics, where contracts, declarations, authorizations, prices, ratings, and classifications may alter relations partly because recognized linguistic or symbolic acts have institutional force.

Gadamer adds a further dimension by treating language as a medium of hermeneutical experience. Understanding does not first occur in a language-free interior and then receive linguistic clothing. Language participates in how a subject matter becomes articulable within dialogue and interpretation (Gadamer 2004). This position differs from Saussure's structural linguistics, Cassirer's transcendental philosophy of culture, Wittgenstein's ordinary-language investigations, and Austin's analysis of speech acts. Yet their juxtaposition establishes a common problem for later theory: symbolic systems do not simply transmit meanings whose form is entirely independent of mediation. The media of articulation participate in what can be distinguished, related, remembered, communicated, contested, and acted upon.

### 2.8.3 Historicity and Interpretive Horizons

Interpretation is historical in more than one sense. Texts, concepts, institutions, and languages have histories; interpreters also occupy historical positions from which some distinctions appear obvious while others remain difficult to formulate. Hermeneutic philosophy gives this double historicity a central place. The problem is therefore not only how an interpreter reconstructs a past meaning. It is also how the interpreter's own historically formed horizon enters the act of understanding.

Dilthey makes historical consciousness fundamental to the human sciences. Human expressions belong to historical nexuses whose meanings change as forms of life, institutions, and cultural possibilities develop (Dilthey 1996). An interpreter seeks to understand a historical expression through the relations in which it participated, while recognizing that the reconstruction occurs from another historical position. Dilthey's hermeneutics thereby links interpretation with a broader philosophy of historical life. Meaning is temporal because human projects, institutions, and self-understandings develop through time.



Heidegger radicalizes historicity by locating it within the temporal structure of existence. Dasein inherits possibilities that it did not originate and projects itself toward possibilities that remain open (Heidegger 1962). Understanding is therefore historically situated before explicit historiography begins. Concepts are inherited through traditions of interpretation, and practical possibilities are available through a world whose meanings have already been formed. This account provides one philosophical route toward the later hermeneutic claim that no interpretation begins from an empty standpoint.

Gadamer's language of horizon and historically effected consciousness develops this insight directly. A horizon is not a fixed boundary enclosing a subject in an incommensurable world. It is the range of possibilities available from a situated standpoint and is capable of movement through encounter and interpretation (Gadamer 2004). Understanding a text or another historical formation requires neither erasing the interpreter's present horizon nor assimilating the object entirely into it. Gadamer describes understanding through a fusion of horizons in which the subject matter can be articulated through a transformed relation between inherited and present questions.

This account also explains why tradition is not merely an external constraint. Traditions supply languages, problems, examples, standards, and expectations through which interpretation becomes possible. They can simultaneously carry exclusions, distortions, or inherited authority. Gadamer's emphasis on openness to questioning is meant to preserve the possibility that an encounter with a text or another interlocutor can challenge the interpreter's expectations. Hermeneutical understanding is therefore historical without becoming a doctrine that all interpretations are equally valid.

Ricoeur introduces distance more strongly into this picture. Once discourse is fixed as text, it can become partially detached from the original speaker's intention and situation, making new readings possible in contexts not foreseen at the moment of composition (Ricoeur 1991). This distancing is not simply a loss of original meaning. It enables critique, comparison, structural analysis, and reappropriation. A text can project a world that later readers inhabit or contest differently. Ricoeur thus gives historical transmission a structure in which continuity and novelty coexist: inherited symbols and narratives constrain interpretation while remaining open to recontextualization.

The relation between interpretation and history is especially important for economic and social concepts. Terms such as labor, property, value, development, welfare, efficiency, risk, household, productivity, and capital do not carry identical meanings across periods and institutions. Their definitions can stabilize sufficiently for measurement, law, policy, and theory while remaining historically revisable. Hermeneutic approaches therefore caution against two symmetrical errors. One is to assume that present categories transparently capture past realities. The other is to conclude that historical variation eliminates the possibility of comparison. Interpretation instead requires reconstruction of the horizons within which categories operated and explicit justification when concepts are translated across contexts.

This historical structure also matters for evaluation. A practice can acquire meanings that differ from those attributed to it by its original participants, and later in-

interpreters may possess evidence, concepts, or normative resources unavailable at the time. Conversely, later frameworks can obscure dimensions that earlier actors understood more readily. Historical interpretation therefore involves a tension between reconstruction and re-description. The interpreter must ask both what a formation meant within its own horizon and what can be learned from examining it through later conceptual resources.

The importance of this lineage for the wider book is methodological rather than relativist. Earlier sections have already argued that evidence, salience, aesthetic judgment, and inquiry have histories. Hermeneutics adds that the categories through which these histories become intelligible are themselves historically positioned. This creates the possibility of later re-epistemization without implying that every reinterpretation is equally adequate. Interpretations remain answerable to texts, traces, actions, material conditions, alternative readings, and the explanatory consequences of the distinctions they introduce.

### 2.8.4 Interpretation Systems and Emerging Syntax

The phrase *emerging syntax* is used in this section as an organizing label rather than as a canonical term belonging to the traditions reconstructed here. It refers to the problem of how relatively stable rules of combination, distinction, continuation, and interpretation can arise and become operative within linguistic, symbolic, and institutional practices. Existing theories approach parts of this problem through different vocabularies: Saussure through linguistic structure and value, Wittgenstein through language-games and rule-following, Austin through conventional conditions of speech acts, Gadamer through dialogical interpretation, and Ricoeur through the relation between text, discourse, and recontextualization.

Saussure's distinction between *langue* and *parole* provides one early way to separate a socially available system from individual acts of speech (Saussure 1966). Particular utterances are possible because speakers participate in a language whose differentiations and combinatorial possibilities are not invented anew on each occasion. Yet language changes through historical use. Saussure's separation of synchronic and diachronic analysis therefore makes it possible to study both relative structural stability and transformation without assuming that one can be reduced to the other.

Wittgenstein relocates the problem of rule-governed language within practices. A language-game has recognizable regularities, but these regularities live in activity rather than functioning as a complete formal code standing outside use (Wittgenstein 2009). Learning a language includes learning how to continue, what counts as a mistake, what distinctions matter, and how correction works. These capacities depend on training, examples, shared practices, and forms of life. The stability of syntax in the broader sense used here can therefore be practical and normative: some continuations are treated as intelligible or appropriate while others are corrected, rejected, or interpreted as belonging to another practice.

Austin's analysis adds institutional felicity conditions. A performative utterance works only within circumstances in which relevant conventions, roles, and procedures obtain (Austin 1962). The sentence alone does not produce the act independently of context. A declaration made by an unauthorized person, a contract lacking

relevant conditions, or a promise uttered in circumstances that defeat the act can fail in different ways. Meaningful linguistic action is therefore coupled to institutional syntax: positions, procedures, conventions, and recognized forms of uptake help determine what an utterance can do.

Gadamer approaches rule and syntax less formally. Hermeneutical dialogue depends on a language that interlocutors inherit, yet successful understanding can transform how a subject matter is articulated (Gadamer 2004). New distinctions may enter a discourse because a question exposes the inadequacy of existing formulations. Old words can acquire revised meanings in new contexts. The horizon of interpretation is therefore structured without being closed. This provides an important contrast with accounts that imagine a complete code from which every valid interpretation can be mechanically derived.

Ricoeur's theory of text gives another route to stability and innovation. Once discourse is fixed, textual organization constrains interpretation; not every reading is compatible with the text. At the same time, distance from the original speech situation permits new configurations of meaning and new applications (Ricoeur 1991). Interpretation is therefore neither unlimited invention nor simple recovery. It operates within structured possibilities whose boundaries can themselves become objects of argument.

These lineages help distinguish at least three questions that later work must keep separate. One concerns the existence of a relatively stable symbolic or linguistic system. A second concerns competent participation in practices governed by rules, conventions, or norms. A third concerns historical change in the very distinctions and continuations that constitute intelligibility. Treating all three as "syntax" would obscure their differences. The broader label is useful only if these levels remain analytically distinguishable.

The same caution applies when interpretive systems extend beyond language narrowly understood. Scientific disciplines, legal orders, accounting systems, bureaucratic classifications, markets, educational institutions, and computational systems each establish repertoires through which some combinations are meaningful, some transformations are authorized, and some observations count as relevant. These systems can be more formalized than ordinary language, but their operation still depends on practices of interpretation. A legal rule must be applied to cases, a statistical category must be operationalized, an accounting classification must be assigned to transactions, and a computational output must be interpreted within a task. Formal syntax can constrain these activities without eliminating the interpretive work through which symbols become consequential.

This point becomes increasingly important under computational mediation. Artificial systems can generate highly regular linguistic and symbolic sequences and can reproduce or recombine patterns learned from large corpora. The philosophical traditions reviewed here advise against identifying such syntactic productivity with the whole problem of meaning. They direct attention toward use, institutional conditions, historical horizons, discourse, and interpretation. At the same time, they also caution against defining meaning through an inaccessible private interior. The resulting question is therefore open rather than settled: how should meaning be analyzed when symbolic continuations are produced through heterogeneous combinations of

human practice, institutional convention, computation, and subsequent interpretation?

For Chapter 2, the significance of this problem is foundational. Existing theories already show that systems of intelligibility can possess structure without being timeless, and that rules can guide action without eliminating interpretation. Later GR work may ask how such structures emerge, stabilize, couple to institutions, and change through repeated use. The present section does not supply that generative theory. It identifies the intellectual resources and distinctions that any such theory would need to inherit.

### 2.8.5 Meaning as Relational and Historical Formation

The traditions reconstructed in this section make it possible to state a limited synthesis without erasing their differences. Meaning can depend on relations among signs, on practical use, on symbolic forms, on speech acts, on historically inherited horizons, on textual organization, and on interpretive encounters. No single lineage establishes all of these claims in the same way. Saussurean difference is not Gadamerian dialogue; Wittgensteinian use is not Cassirer's symbolic form; Dilthey's historical understanding is not Austin's illocutionary analysis; and Ricoeur's hermeneutics of text cannot be reduced to Heidegger's existential analytic. Their convergence lies at a more modest level: meaning is difficult to understand as an intrinsic property that remains fully determinate independently of linguistic, symbolic, practical, and historical relations.

This convergence offers a foundation for analyzing social and economic reality. A price is a number, but its meaning depends on a currency, unit, market setting, temporal reference, contractual context, and expectations about what is being exchanged. A legal category is expressed through words, but its practical meaning depends on doctrine, institutional authority, procedures, precedent, and application. A statistical indicator is formally defined, yet its significance depends on classifications, measurement practices, comparison groups, policy contexts, and interpretive conventions. These examples do not imply that material reality is produced by language alone. They show that materially consequential action often proceeds through interpretive and symbolic infrastructures.

The historical character of these infrastructures matters equally. A category that becomes stable enough to organize conduct can later be revised, contested, subdivided, translated, or abandoned. The history of interpretation therefore concerns more than changing opinions about a fixed object. The categories through which actors recognize objects, positions, obligations, and possibilities can themselves change. When those categories are embedded in law, accounting, administration, technology, or markets, interpretive change can alter material trajectories by changing what actions are available, intelligible, or institutionally recognized.

This possibility also clarifies the relation between interpretation and normativity. Language-games and institutional speech acts involve standards of appropriate use; hermeneutical traditions concern better and worse interpretations; historical inquiry requires judgments about evidence and contextual adequacy. Interpretation is therefore not normatively empty. Yet semantic, epistemic, aesthetic, legal, and moral

norms should not be collapsed. A linguistically well-formed statement can be false, a historically plausible interpretation can be unjust in its consequences, and a legally valid classification can remain ethically contestable. The earlier argument that aesthetic and normative judgment may co-evolve without becoming identical has an analogue here: interpretive and normative orders can influence one another while remaining distinguishable objects of analysis.

The same recursive structure appears across the genealogy. Interpretation occurs under conditions that precede a particular act of understanding: languages, symbolic forms, concepts, traditions, institutions, and rules are already available. Those conditions are nevertheless historical products. Earlier acts of interpretation, classification, translation, institutionalization, and contestation participated in forming them. A later interpretation can in turn reinforce, modify, or destabilize the conditions inherited by subsequent interpreters. Existing hermeneutic and linguistic theories provide much of the conceptual material needed to recognize this recursion, even when they do not formulate it in generative-relational terminology.

This is the point at which a restrained GR bridge becomes possible. Later GR work may investigate interpretive relations as part of generative systems: how actors, signs, categories, institutions, technologies, and material conditions participate in producing relatively durable regimes of intelligibility; how those regimes shape subsequent perception and action; and how new encounters or conflicts alter the interpretive conditions inherited by later subjects. Such a project would extend rather than replace the traditions reconstructed here. It would also need to preserve their warnings against several reductions: meaning cannot be treated as merely private intention, merely formal syntax, merely arbitrary convention, or merely the passive reflection of an independently completed social structure.

The problem is especially consequential for a generative relational economics. Economic categories do not only describe economic activity. Once stabilized through contracts, standards, accounting, statistics, organizations, platforms, and policy, they can participate in coordinating and transforming that activity. At the same time, their effectiveness depends on material infrastructures, power relations, legal authority, and practical uptake. Interpretation therefore belongs neither wholly outside economic reality nor wholly above it. It can become one of the relations through which economic objects and possibilities acquire operational form.

This conclusion prepares the transition to the next sections of the chapter. Hermeneutics and philosophy of language show how understanding is mediated by historically inherited structures whose meanings remain open to interpretation and transformation. The genealogy can now move from interpretation toward the philosophy of relation itself. The next problem is therefore broader than linguistic mediation: what does it mean for relation to be analytically or ontologically significant, and how have different philosophical traditions conceptualized relations among entities, processes, structures, and becoming? The following section takes up that problem while retaining the interpretive cautions established here.

## 2.9 Philosophy of Relation

Earlier sections introduced relation as one possible ontological and analytical category and then examined specifically interpretive, linguistic, phenomenological, and dialogical forms of relationality. The present section reconstructs a broader philosophical genealogy of relation itself. Its role is to clarify the intellectual resources through which relations can be treated as predicates of already constituted things, as irreducible facts connecting distinct terms, as conditions partly constitutive of identity or capacity, and as elements within structures whose own relations can become objects of analysis. The discussion proceeds through five problems: substance-first and relation-first traditions; the controversy over internal and external relations; relational constitution; higher-order relations; and relations among relations. The method remains comparative and genealogical. Aristotle, Bradley, Moore, Russell, Cassirer, Whitehead, Peirce, and contemporary structural realism do not form a single relational school, and their disagreements concern precisely the questions that later GR work must keep open: what the relata are, whether relations add anything to their terms, how strongly identity depends on relational position, and whether relational structures can themselves be related without an explanatory regress.

### 2.9.1 Substance-First and Relation-First Traditions

A long-standing philosophical route begins with substances or things and subsequently asks which properties and relations can be predicated of them. Aristotle provides an especially influential point of departure. In the *Categories*, relatives are treated as one category among several, while primary substance occupies a privileged position in the account of what is neither said of a subject nor present in a subject (Aristotle 1963). The Aristotelian corpus is too complex to reduce to a simple opposition between substances and relations, and Aristotle's discussions of form, causation, dependence, and actuality introduce structures that exceed a picture of isolated bearers of predicates. The categorical framework nevertheless provides a durable model in which relation is intelligible through terms that can be distinguished from the relation they bear.

The substance-first orientation remained attractive because it supplies a clear grammar for individuation and predication. One first determines what the relevant thing is and then asks what it is like, what it can do, and how it stands to other things. Much ordinary economic description retains this structure. A household, firm, worker, commodity, or state can be treated as a unit with properties, after which exchange, employment, ownership, competition, or obligation are represented as relations among those units. Such an approach can be analytically adequate whenever the identities and capacities of the units are sufficiently stable for the problem under investigation.

Modern philosophy and science also generated traditions in which this ordering became less secure. Cassirer's *Substance and Function* reconstructs an important transformation in scientific concepts from classification by fixed substantial features toward concepts whose contents are determined through systems of functional relations (Cassirer 1923). In such a framework, the position occupied within an ordered



system can become more explanatory than resemblance to a paradigmatic thing. Cassirer's historical argument concerns the changing form of scientific concept formation: modern mathematics and physics increasingly employ concepts whose determinations arise through law-governed relations and series while retaining objects as positions within those systems.

Whitehead's process metaphysics offers another departure from substance-centered analysis. In *Process and Reality*, actual entities are treated through becoming, prehension, and inheritance from an already actual world; relational incorporation enters the account of actuality itself (Whitehead 1929). Whitehead's speculative metaphysics differs substantially from Cassirer's neo-Kantian account of concept formation. Their juxtaposition is useful because it reveals two distinct routes away from explanatory priority for self-sufficient substances: one concerns how scientific objects are conceptually determined; the other concerns a metaphysics in which becoming and relational incorporation enter the constitution of actuality itself.

Contemporary structural realism provides a further family of relation-sensitive positions. Ladyman distinguishes epistemic structural realism, which limits or redirects what can be known toward structure, from ontic structural realism, which gives structure and relations a stronger metaphysical role (Ladyman 1998). The resulting debate is internally diverse. Some structural realists retain objects while denying that they possess a fully independent intrinsic nature; stronger versions question whether fundamental individuals are required at all. Critics respond that relations appear to require relata and that purely structural description can underdetermine which worldly relations are intended. Structural realism therefore does not supply a settled relation-first ontology. It makes explicit a problem that had appeared in earlier forms: whether explanatory or ontological priority can shift toward structure without rendering the terms of relation unintelligible.

The historical contrast between substance-first and relation-first traditions should therefore be understood as a spectrum of explanatory priorities rather than a binary taxonomy. A theory may preserve entities while making some of their properties relationally dependent. It may treat relations as irreducible facts without claiming that relata are constituted by them. It may give structure epistemic priority while remaining agnostic about ultimate ontology. It may also treat the distinction between thing and relation as locally useful while denying that either side can be given unconditional priority. This range of positions provides the first foundation required by a generative relational programme: philosophical attention can shift toward relation without requiring an immediate metaphysical abolition of entities.

### 2.9.2 Internal and External Relations

The controversy over internal and external relations sharpened the question of how much a relation contributes to what its terms are. The terminology has changed across periods, and different authors use *internal* in different senses. One recurrent question asks whether a relation follows from, or belongs necessarily to, the natures of the terms related. Another asks whether a relational fact constitutes an addition to the intrinsic properties of its relata. A third asks whether terms can be adequately

conceived independently of the larger whole in which they participate. These formulations overlap without being identical.

Bradley's *Appearance and Reality* became a major reference point for the British debate because it attacks attempts to understand qualities and relations as independently intelligible elements subsequently combined into a complex (Bradley 2011). His discussion of "Relation and Quality" argues that qualities considered apart from relations are abstractions, while relations considered as independently linking already constituted qualities generate further difficulties. The familiar Bradley regress emerges from this pressure: if a relation must itself be related to its terms in order to unify them, an additional relation appears to be required, and the same question can recur. Bradley's broader metaphysics directs these difficulties toward a more holistic conception of reality.

Bradley's position requires historical care. Later summaries sometimes present him simply as a defender of the doctrine that every relation is internal. His critique is more radical than that formula suggests. He objects to external relations understood as independently subsisting connectors, while his later writings also resist an uncomplicated reduction of every relation to the intrinsic qualities of separate terms. The enduring philosophical contribution of the controversy lies less in a single doctrine than in the problem it exposes: a relation must connect distinguishable terms, yet an account of that connection cannot automatically assume that the terms are wholly intelligible prior to the relation.

Moore's "External and Internal Relations" responds to the idealist controversy by distinguishing relations whose possession belongs necessarily to a term from relations that can vary while the term remains numerically the same (Moore 1920). The paper thereby defends the intelligibility of purely external relations. A thing can stand in some relation at one time and fail to stand in it at another without every such difference constituting a change in the thing's intrinsic nature. Moore's analysis is significant for later relational inquiry because it blocks an inference from the importance of relations to the conclusion that every relation is constitutive of every relatum.

Russell's break with British idealism makes external relations central to the development of analytic philosophy and mathematical logic. *The Principles of Mathematics* treats relations as genuine logical constituents and emphasizes relations that cannot be reduced to monadic predicates of isolated terms (Russell 1903). Asymmetrical relations such as earlier than, greater than, or being to the left of resist a subject-predicate analysis that attempts to locate the whole relational fact inside one term. Serial order in particular requires attention to relational structure. Russell's logical programme therefore supplies a powerful reason for granting some relations irreducibility: mathematics itself depends on relational forms whose direction, order, and composition matter.

The internal-external controversy leaves a useful set of distinctions without resolving every metaphysical question. Some relations plausibly depend on intrinsic characteristics of their relata. Others can vary without changing what the relata are under the relevant description. Still others enter the very description by which the relatum is identified: creditor, parent, employee, citizen, and owner are examples in which a role is intelligible through a relation. The same concrete entity can therefore

bear relations with different degrees of constitutive significance. This variation is important for later economic analysis. Treating all relations as external can miss how institutions form capacities and identities; treating all relations as internal can make every connection constitutive and thereby weaken analytical discrimination.

A further lesson concerns scale and description. Whether a relation is internal can depend on what is being individuated. A person may remain the same biological individual after leaving an organization, while the institutional subject-position of “director” ceases when the relevant organizational relations dissolve. A firm’s physical assets may persist while its legal identity changes through merger, bankruptcy, or reorganization. Philosophical disputes about internality therefore anticipate a methodological question that becomes central in social inquiry: the unit of identity must be specified before the constitutive force of relation can be assessed.

### 2.9.3 Relational Constitution

Relational constitution names a stronger possibility than the mere existence of relations. The relevant claim is that some feature of a thing – its identity, capacity, status, intelligibility, or mode of persistence – depends partly on the relations in which it stands. Philosophical traditions disagree about which features can be constituted in this way and about whether such constitution is conceptual, epistemic, social, causal, or metaphysical. The distinction matters because a relation can be causally influential without constituting its relata, and it can be constitutive under one description while remaining contingent under another.

Cassirer’s functional conception illustrates relational determination at the level of scientific concepts. An object in a mathematical or scientific series can be identified through the law governing its position within a system rather than through possession of a self-contained qualitative essence (Cassirer 1923). The object remains distinguishable, yet the intelligibility of that distinction depends on the ordered relations in which it participates. This form of relational constitution concerns conceptual determination and should not be translated automatically into a universal claim about what exists independently of conceptual practice.

Whitehead offers a stronger metaphysical version. His actual entities arise through processes that take account of, or “prehend,” an already constituted world; an actuality’s becoming therefore includes relations to antecedent actualities within its own constitution (Whitehead 1929). Whitehead’s account is highly specific and carries theological, cosmological, and metaphysical commitments that GRE need not inherit. It nevertheless demonstrates a coherent philosophical possibility: relational dependence can belong to the formation of an entity rather than appearing only after the entity has been completely constituted.

Structural realism reopens the issue in the philosophy of science. Ontic structural realist positions ask whether the identity and individuality of physical objects can depend on the structures in which they occur, particularly where contemporary physics challenges classical assumptions about independently individuated particles (Ladyman 1998). Moderate versions preserve relata while denying that they need an intrinsic nature fully separable from their relations. Stronger versions give structure greater ontological priority. The continuing debate over “relations without relata”

shows that relational constitution admits degrees. One may reject self-sufficient objects without eliminating objects altogether.

The distinction between *constitution* and *determination* is especially useful here. A relation may determine which value a property takes without constituting the bearer of that property. A relation may constitute a role while leaving the underlying person or organization intact under another description. A web of relations may constitute an institution in the sense that the institution ceases when the relevant practices, recognitions, and obligations disappear. Each of these claims has a different strength. Philosophical clarity requires the analyst to identify which level of dependence is being asserted.

This graded conception helps connect metaphysical debates with later social and economic traditions without collapsing them. A contract can generate obligations whose existence depends on legally recognized relations. A market position can depend on relations of access, dependence, competition, and information. A capability can be affected by infrastructural and institutional relations. These examples establish neither that persons are reducible to relations nor that all economic objects are relational constructions. They show why the category of relational constitution is analytically necessary whenever an object's economically relevant identity or capacity changes with the relational configuration that sustains it.

Relational constitution also raises a temporal question that belongs primarily to the subsequent process-and-emergence discussion. If a relation helps constitute an entity at one time, the formation, persistence, and dissolution of that relation become part of the entity's history. Constitution can therefore be diachronic rather than instantaneous. The present section establishes only the philosophical possibility; the next step in the genealogy concerns theories of becoming through which constitutive relations themselves can arise and transform.

#### 2.9.4 Higher-Order Relations

Philosophy and logic also expand the analysis of relation by distinguishing relations according to arity, order, and structural role. A relation need not be represented only as a simple tie between two independently characterized objects. Peirce's logic of relatives is an important nineteenth-century development because it treats relational form systematically and gives special attention to dyadic and triadic relations (Charles Sanders Peirce 1960). His writings on relatives develop an algebra and logic capable of analyzing how terms occupy distinct places within relational forms. Peirce's insistence on genuine triadic relations is especially significant because it challenges the assumption that every complex relation can be decomposed without remainder into a collection of dyadic ties.

Russell's logic of relations develops a different programme but reinforces the idea that relations possess formal characteristics worthy of analysis in their own right (Russell 1903). Relations can be symmetrical or asymmetrical, transitive or intransitive, serial or non-serial; they can have converses and enter products or compositions. Such properties concern the relation's form across possible or actual instances. Logical analysis therefore moves beyond asking whether a particular pair is related and begins to investigate what kind of relation structures a domain.

This development opens a route toward what may be called *higher-order relational analysis*. The phrase is used here as an organizing label rather than as a doctrine attributed uniformly to Peirce or Russell. A first-order inquiry asks which entities stand in a specified relation. A higher-order inquiry may ask how one relation depends on another relation, how relations compose, whether one relational pattern constrains another, or how a system of relations acquires properties that no single dyad possesses. The logical traditions make these questions intelligible even though their original aims were mathematical and logical rather than social-scientific.

Structural realism supplies another version of higher-order reasoning. Epistemic structural realist positions have sometimes characterized scientific knowledge in terms of structural properties, including relations among relations, rather than complete knowledge of the intrinsic natures of unobservable objects (Ladyman 1998). The philosophical controversy surrounding this move is instructive. Purely formal structure can become too weak if any sufficiently large domain can instantiate an isomorphic pattern. A useful relational account therefore requires constraints on which relations matter, how they are identified, and what empirical or conceptual content fixes their interpretation. Higher-order structure cannot substitute automatically for substantive knowledge of the domain.

Higher-order relations are particularly important when direct ties derive their meaning from a wider relational architecture. The significance of an employment relation depends partly on legal relations, organizational authority, market alternatives, and social norms. The meaning of a credit relation depends partly on property rules, monetary institutions, accounting classifications, enforcement capacities, and relations of trust. These examples involve several kinds of relation whose interaction cannot be represented adequately by counting dyadic ties alone. The philosophical lineage does not yet provide a social theory of these configurations. It provides conceptual permission to treat relations themselves as analytically structured objects.

This permission should remain disciplined. Higher-order vocabulary can easily become a verbal substitute for specifying the mechanism under study. An analyst must identify what the relevant relations are, which relations take other relations or relational configurations as their objects, and how the higher-order structure changes explanation. The logical history of relations therefore supports greater complexity while also demanding greater precision.

### 2.9.5 Relations among Relations

The final problem concerns relations among relations themselves. Once relations are treated as analytically significant, it becomes possible to ask how they reinforce, inhibit, translate, authorize, represent, or transform one another. This question extends beyond higher arity. A triadic relation may still be a single relation among three terms, whereas a relation among relations concerns dependencies or structures in which relational configurations become *relata* for further analysis.

Bradley's regress provides an early warning about this move. If every relation requires another relation to connect it to its terms, explanatory work can be displaced into an indefinite sequence (Bradley 2011). A theory therefore needs some account of where relational articulation is primitive, where it is derivative, or how a complex



unity is constituted without merely adding another connector. Russell responds in a different direction by allowing relating relations to be primitive components of facts rather than demanding that each act of relating receive a further relational explanation (Russell 1903). The disagreement remains philosophically valuable because it identifies a boundary condition for relational theorizing: more relations do not automatically produce deeper explanation.

The logical traditions also show that relations can stand in systematic connections to other relations. Converse, composition, implication among relational forms, and classification by formal properties create a level at which relational patterns can be compared and combined. Peirce's logic of relatives and Russell's relational logic make such operations explicit (Charles Sanders Peirce 1960; Russell 1903). These logical constructions should not be transferred directly into social ontology. They demonstrate that a domain can possess organization at the level of relations themselves and that this organization may have properties not visible from isolated relational instances.

Cassirer's functionalism adds a historical-epistemological dimension. Scientific concepts often belong to systems in which the determination of one function depends on its place among other functions and laws (Cassirer 1923). Structural realism similarly asks what remains invariant or structurally continuous when theoretical descriptions of individual entities change (Ladyman 1998). Both lineages make relations among relations philosophically salient, although one concerns the formation of scientific concepts and the other the interpretation of scientific theories and reality. Their difference should be preserved.

For a later generative relational programme, this genealogy makes several questions available without settling them. A legal relation may authorize an ownership relation; an ownership relation may condition a labor relation; a labor relation may reproduce a status relation; a change in technological relations may alter bargaining relations and thereby modify the conditions under which future contracts are formed. The explanatory object in such cases is neither an isolated entity nor a single tie. It is a structured configuration in which relations condition the formation, persistence, and transformation of other relations.

The same point introduces an important distinction between *relational analysis* and the stronger *generative analysis* developed later in this book. Relational analysis identifies constitutive connections, positions, dependencies, and structures. Generative analysis additionally asks how those relations produce later subjects, capacities, institutions, constraints, and possibilities, including changes in the relations and rules through which subsequent generation occurs. Section 2.9 supplies philosophical precedents for the first task and a conceptual opening toward the second; it does not establish that any historical theory already contains the later GR framework.

The philosophical genealogy of relation therefore ends with a productive incompleteness. Substance-centered ontology preserves the importance of relatively persistent relata. External-relation theories preserve contingency and the possibility that connections change without every identity changing with them. Internal and constitutive accounts show that some identities and capacities are inseparable from relational conditions. Logic demonstrates that relations differ in arity and form and can enter higher-order structures. Structuralist traditions test how far explanatory pri-



ority can be assigned to structure while exposing the difficulties of relations without adequately specified relata. Taken together, these lineages make a relational research programme intellectually possible while leaving its strongest ontological claims open. The subsequent genealogy of process, becoming, and emergence adds the temporal problem that this section has largely held fixed: how entities and relations come to be, how novelty occurs, and how the conditions of transformation themselves can change.

## 2.10 Process, Becoming, and Emergence

The philosophy of relation reconstructed in the preceding section largely held temporal transformation in the background. Relations could be internal or external, constitutive or contingent, dyadic or higher-order, while the analytical question remained principally one of structure. The present section introduces a different family of problems: how events occur, how processes persist through change, how genuinely new configurations can arise, how historical sequences constrain later possibilities, and how the conditions under which transformation occurs may themselves be transformed. Its role is genealogical. Process philosophy, pragmatism, evolutionary thought, emergentism, path-dependence research, historical sociology, structuration theory, and morphogenetic social theory address overlapping temporal problems without forming a single doctrine. The discussion therefore proceeds through five distinctions: process and event; becoming and transformation; emergence and novelty; historical and path-dependent becoming; and transformation of the conditions of transformation. These traditions make a later generative analysis intellectually possible, but they should not be read retrospectively as incomplete versions of GR.

### 2.10.1 Process and Event

One route toward a processual account of reality begins by shifting explanatory attention from enduring things to occurrences. The shift can be metaphysical, methodological, or both. A process philosophy may claim that processes or events are ontologically basic; a more modest approach may retain relatively persistent entities while insisting that their persistence, capacities, and interactions are intelligible only through temporally extended activity. The history of process philosophy contains both possibilities, and the distinction matters because treating change as analytically primary does not by itself require a complete process metaphysics.

Whitehead provides the most systematic twentieth-century metaphysical example. In *Process and Reality*, the basic units of actuality are event-like “actual occasions” rather than enduring substances understood as self-identical bearers of changing properties (Whitehead 1929). An actual occasion becomes through the integration of inherited data from an already actual world; once completed, it enters the world as datum for subsequent becoming. Persistence is therefore reconstructed through patterns of succession and inheritance rather than assigned to an independently enduring substance. Whitehead’s vocabulary of concrescence, prehension, and nexus belongs to a speculative metaphysical system and should not be imported directly into economic analysis. Its historical importance lies in demonstrating how a philos-

ophy can make occurrence, dependence on a prior world, and temporal production constitutive of what counts as actuality.

John Dewey reaches processual conclusions through a different route. *Experience and Nature* treats experience as an interaction within nature and repeatedly emphasizes the conjunction of stability and precariousness, continuity and interruption, habit and novelty (Dewey 1925). Dewey's naturalism does not begin from Whitehead's categorial scheme. It begins from transactions in which organisms act within environments, encounter uncertain conditions, and reconstruct habits and situations through inquiry and practice. Events matter because situations develop, consequences unfold, and what is experienced as a stable object or institution can be understood through histories of interaction. Dewey therefore contributes a pragmatist process vocabulary in which temporal organization is inseparable from practical engagement.

George Herbert Mead's *The Philosophy of the Present* adds a particularly important account of the event. Mead treats the present as the locus in which novelty occurs and argues that the occurrence of an emergent event can reorganize the meaning of the past from the standpoint of a changed present (Mead 1932). The past is not simply annihilated or freely invented. Evidence constrains historical reconstruction, while the significance assigned to earlier events can change when a later event creates new relations among them. Mead's analysis is therefore important for any historical theory in which temporal order is more than the accumulation of successive states. An event can be consequential because it changes what earlier events now mean for a developing process.

These process traditions also complicate the relation between event and continuity. If analysis isolates only discrete events, it can obscure the processes through which events become possible and acquire consequences. If analysis speaks only of continuous process, it can obscure thresholds, interruptions, and episodes that reorganize later development. Whitehead emphasizes event-like actualization within a wider process of becoming; Dewey analyzes problematic situations and their reconstruction; Mead focuses on emergent presents that alter the organization of temporal perspectives. Their conceptual vocabularies differ, but each resists reducing temporality to a sequence of externally dated snapshots.

For economic inquiry, this lineage offers a general methodological caution. A market transaction, institutional reform, technological adoption, strike, financial crisis, contract, or policy decision can be treated as an event, yet its intelligibility depends on processes that precede and follow it. Conversely, a long-run process such as industrialization or financialization is not adequately described if the events through which its direction changes disappear into a smooth trend. Process and event therefore designate complementary analytical resolutions. The historical traditions reconstructed here establish that temporal organization can itself be an object of theory before any specifically generative account is introduced.

### 2.10.2 Becoming and Transformation

The language of becoming adds a stronger problem to the analysis of process. Change may be represented as variation in the properties of something whose identity re-

mains fixed. Becoming asks when the object, capacity, relation, or field of possibilities under analysis is itself being constituted through change. The distinction is not absolute: many theories combine relatively persistent carriers with transformational processes. It nevertheless identifies a recurring disagreement over whether temporal development should be modeled primarily as movement among pre-specified states or as a process capable of producing new determinations.

Bergson's *Creative Evolution* is a major philosophical statement of this problem. Bergson distinguishes lived duration from a spatialized representation of time in which succession is reconstructed as a series of discrete positions (Bergson 1911). Duration names a qualitative continuity in which earlier moments persist into later ones and in which change cannot always be decomposed without remainder into a sequence of already specified states. His broader evolutionary argument is tied to a vitalist metaphysics that later biology did not adopt. The enduring conceptual resource is narrower: becoming may involve qualitative differentiation for which a static state-space representation is analytically incomplete.

Dewey's naturalism develops transformation without Bergson's vitalism. Organisms and environments are not treated as fully independent terms whose interaction leaves each side conceptually unchanged. Habits develop in response to environmental conditions; action modifies environments; altered environments create new problems and opportunities for subsequent action (Dewey 1925). Transformation can therefore concern both the acting unit and the situation within which action takes place. Dewey's account remains grounded in inquiry, habit, and practical adaptation rather than in a universal metaphysics of creative evolution.

Evolutionary economics later developed an explicitly economic account of temporally changing capabilities and routines. Nelson and Winter reject a picture in which firms can be adequately represented as timeless optimizers with fixed technologies and complete knowledge. Their evolutionary framework analyzes organizational routines, search, innovation, differential growth, and selection as processes through which industries change over time (Nelson and Winter 1982). The analogy with biological evolution is selective rather than literal. Firms possess routines that can persist and reproduce; search introduces variation; market competition affects survival and expansion; and the population of routines and firms changes through time. Economic transformation is thereby represented as an endogenous historical process rather than merely a comparative statics exercise.

This lineage clarifies several different meanings of transformation. A system may move while retaining its organizing relations. An entity may alter its properties while preserving its identity for the purposes of analysis. A population may change composition because heterogeneous units survive or reproduce at different rates. Routines and institutions may be revised. The categories through which actors perceive and act may also change. These processes need not share one mechanism. "Becoming" is therefore most useful as a prompt to specify what is becoming different, on what timescale, through which mechanism, and with what degree of continuity.

The distinction between movement and transformation is especially important for later economic analysis. A price change within an established market differs from a change in the rules that define what may be traded. A firm's adjustment within an existing technological regime differs from the emergence of a new technological

regime. A worker's movement between jobs differs from a transformation in the legal and organizational constitution of employment. The earlier process traditions do not dictate one formalism for these cases. They establish a conceptual basis for asking whether the space of relevant states, identities, or relations should itself be treated as historically variable.

### 2.10.3 Emergence and Novelty

Emergence addresses a more specific question: when a new property, capacity, level of organization, or pattern appears, in what sense is it dependent on what preceded it, and in what sense does it possess explanatory autonomy? The modern concept developed through several traditions, including British emergentism, evolutionary philosophy, philosophy of mind, and later sciences of complex systems. The resulting literature contains substantial disagreement over whether emergence is epistemic, ontological, causal, explanatory, or merely relative to a chosen level of description.

C. Lloyd Morgan's *Emergent Evolution* presents one of the canonical British emergentist accounts. Morgan distinguishes resultant combinations from cases in which a new kind of quality appears at a higher level of organization and cannot be treated simply as an additive continuation of lower-level properties (Morgan 1923). His theory is embedded in an evolutionary and metaphysical framework characteristic of its period. Its importance for later discussion lies in the attempt to combine continuity of evolutionary development with qualitative novelty.

C. D. Broad gave the emergentist problem a more precise formulation in *The Mind and Its Place in Nature*. Broad asks whether the characteristic behavior of a complex whole could, even in principle, be deduced from complete knowledge of its components considered in isolation and in other combinations (Broad 1925). Emergence, in this formulation, concerns the appearance of properties associated with a particular organization of constituents whose behavior is not derivable through the laws already known for those constituents in other contexts. Broad's criterion mixes an epistemic test of deducibility with a metaphysical claim about genuinely distinctive laws, and later philosophers have repeatedly questioned whether failure of prediction or deduction is sufficient to establish ontological novelty.

Twentieth-century physics supplied a different motivation for anti-reductionist language. Anderson's essay "More Is Different" argues that knowledge of fundamental laws does not eliminate the need for autonomous concepts and explanations at higher levels of organization (P. W. Anderson 1972). Broken symmetry and collective organization provide examples in which new principles become necessary for understanding macroscopic behavior. Anderson's argument does not reproduce British emergentism, nor does it establish that higher-level properties are metaphysically independent of lower-level physics. It strengthens the methodological claim that derivational priority and explanatory sufficiency are different questions.

Contemporary philosophy of emergence often organizes the problem around some combination of dependence and autonomy. Emergent phenomena are expected to depend on lower-level constituents or conditions while displaying patterns, properties, or causal/explanatory roles that justify a partially autonomous description. The balance is difficult. If autonomy is made too strong, emergence approaches dualism

or unexplained novelty. If dependence is made so strong that higher-level regularities add no explanatory content, emergence collapses into ordinary composition. The literature therefore warns against using the term merely because a system is complicated or because an outcome was unexpected.

Novelty is similarly ambiguous. Something may be novel to an observer because it was not predicted. It may be historically novel because a configuration has not previously occurred. It may be structurally novel because new relations or capacities become available. It may be ontologically novel under a stronger metaphysical interpretation. These senses should remain distinct. A new market institution, for example, may be historically unprecedented without requiring a philosophical claim about strong emergence. A collective property of a market network may require a higher-level description without implying that lower-level mechanisms are causally irrelevant.

For a later generative relational programme, the emergence literature supplies two important constraints. First, emergence requires an account of dependence: a new configuration must be related intelligibly to conditions from which it arises. Second, novelty cannot be inferred merely from the analyst's surprise. The specific respect in which something is new, irreducible, autonomous, or causally consequential must be stated. Chapter 2 therefore uses emergence as a historically developed problem-field, leaving the stronger GR question of generative production for later chapters.

#### **2.10.4 Historical and Path-Dependent Becoming**

Process and emergence become historically sharper when sequence matters. Path dependence identifies classes of processes in which the consequences of an event depend on the trajectory through which the system arrived at its present configuration. The concept has been developed especially in economics, economic history, political science, and historical institutionalism. It should be distinguished from the weak observation that history matters. A path-dependent explanation specifies mechanisms through which earlier events alter the probabilities, payoffs, capabilities, or institutional conditions governing later developments.

Arthur's analysis of competing technologies provides a canonical economic formulation. Under increasing returns to adoption, an initially small advantage can be amplified because adoption itself raises the attractiveness of a technology through learning, coordination, network effects, or related mechanisms (Arthur 1989). Early contingencies can therefore influence which equilibrium or technological standard becomes dominant. The argument is mechanism-specific: historical sensitivity follows from positive feedback and increasing returns, rather than from history as such.

Paul David's account of QWERTY brought related historical reasoning into economic history. His analysis emphasizes how technical interrelatedness, scale economies, and quasi-irreversibility can make an early sequence consequential for later technological development (David 1985). The empirical interpretation of QWERTY subsequently became controversial, which is itself methodologically instructive. Path dependence is not established by identifying persistence after an early choice; one must show the mechanisms that make reversal costly or self-reinforcement consequential.



Nelson and Winter's evolutionary economics broadens historical dependence beyond lock-in. Firms inherit routines, capabilities, and organizational memories that shape their search behavior and feasible adaptations (Nelson and Winter 1982). Economic development is therefore cumulative: current action depends on competencies produced by earlier learning, while search and selection modify the population of routines available for future action. This tradition places path dependence within a wider evolutionary analysis of heterogeneous organizations.

Political science and historical institutionalism extend the logic to institutional development. Pierson argues that increasing-return processes can make timing and sequence consequential in politics because institutions, collective-action structures, authority relations, and adaptive expectations may create self-reinforcing effects (Pierson 2000). His analysis also emphasizes that political processes differ from market competition and therefore require their own mechanisms. The concept of path dependence is useful precisely when it specifies how a prior institutional arrangement alters subsequent costs, capacities, coalitions, or expectations.

Historical sociology adds an event-centered account of structural transformation. Sewell's analysis of the taking of the Bastille argues that historical events can become transformative when interconnected actions acquire new interpretations and reorganize the structures through which subsequent action becomes intelligible and possible (Sewell 1996). Events are consequential not simply because they occur at an earlier date. Their significance can be amplified through collective interpretation, resource mobilization, and changes in schemas. This brings path-sensitive history into contact with the process question introduced by Mead: later developments can reorganize the meaning and causal role attributed to earlier occurrences.

These literatures together distinguish several kinds of historical dependence. Positive feedback can stabilize a selected path. Accumulated capabilities can make some adaptations easier than others. Institutional arrangements can distribute resources and authority in ways that reproduce themselves. Interpretive events can transform schemas and thereby change subsequent action. None of these mechanisms should be collapsed into a generic concept of "history." A rigorous historical account identifies what is carried forward from one period to another and how that inheritance changes later possibilities.

This distinction is particularly important for economic transformation. History can matter through sunk investment, legal precedent, technical standards, organizational learning, social expectations, infrastructures, classifications, or distributions of power. Different forms of inheritance operate on different timescales and may reinforce or counteract one another. Path dependence therefore prepares a later generative analysis by establishing that present possibilities are partly produced by historical trajectories, while leaving open the question of how trajectories can also modify the mechanisms through which future trajectories are generated.

### **2.10.5 Transformation of the Conditions of Transformation**

The strongest temporal problem in this genealogy arises when change modifies the conditions under which later change occurs. This differs from ordinary movement within a fixed rule system. It also differs from a single structural transition followed



by a new stable regime. The problem is recursive: practices, institutions, schemas, capacities, and relations can be reproduced or altered through action, and their alteration can change what forms of action and transformation are subsequently possible. Several major social theories address this problem through different conceptual architectures.

Giddens's theory of structuration formulates one influential response through the "duality of structure." Structures are implicated in the production of social practices while being recursively reproduced through those practices (Giddens 1984). Rules and resources are therefore both medium and outcome of recurrent social action. This formulation rejects an image of structure as an external object that acts upon otherwise independent agents. At the same time, critics have argued that the close analytical identification of structure and practice can make it difficult to specify temporal sequences in which prior structural conditions and later transformations are empirically distinguished.

Sewell reformulates this problem by treating structures as composed of mutually sustaining schemas and resources while placing stronger emphasis on agency and the possibility of transformation (Sewell 1992). Schemas can be transposed to new contexts; resources are multiple and unevenly distributed; and actors possess capacities that allow them to reinterpret or mobilize structural elements in ways that generate change. His later analysis of historical events develops this temporal dimension further: an event can transform structures when chains of action and interpretation alter the schemas and resources that organize subsequent practice (Sewell 1996). The conditions of action are therefore historically inherited yet potentially reconstituted through consequential events.

Archer's morphogenetic approach develops a contrasting solution by insisting on analytical separation across time. Structural and cultural conditions predate a given round of interaction; actors respond within those conditions; the resulting interaction can reproduce existing arrangements or generate structural and cultural elaboration that conditions a subsequent cycle (Archer 1995). Archer calls attention to "double morphogenesis": agents can transform social structures while the same process transforms the agents and collectivities capable of later action. Her analytical dualism differs sharply from Giddens's duality of structure. The disagreement is productive because both theories confront the recursive relation between inherited conditions and their reproduction or transformation while proposing different ways to preserve explanatory sequence.

These social theories can be placed beside evolutionary and path-dependent accounts without being assimilated to them. Nelson and Winter show how routines and search processes change organizational capabilities; Arthur shows how positive feedback changes the later attractiveness of alternatives; Sewell shows how events can transform schemas and resources; Giddens emphasizes recursive reproduction; Archer separates conditioning, interaction, and elaboration across time. Each provides a different answer to the question of how a process can alter what will count as a possible or probable transformation in the next period.

The phrase *transformation of the conditions of transformation* is used here as an organizing expression for this shared problem, not as a canonical term attributed to any of these authors. It identifies a level of inquiry at which the analyst asks more than

what changed. One also asks whether the mechanisms, capacities, rules, relations, or interpretive resources governing later change have been altered. A constitutional reform may change policy while also changing the procedures through which later reforms can occur. A technological platform may create new products while altering the architecture through which future innovations reach users. A labor institution may change wages while also changing bargaining capacities and the organizational forms through which later claims are made. These examples remain illustrative; the section's purpose is to establish the lineage of the problem rather than to provide a completed GRE theory of recursive transformation.

This genealogy makes several resources available to later GR work. Process philosophy establishes that occurrence and becoming can be analytically primary. Bergson and pragmatist traditions show that temporal development need not be represented exhaustively as movement among pre-given states. Emergentism separates dependence from autonomy and forces greater precision about novelty. Evolutionary economics and path-dependence research demonstrate how histories produce differentiated later possibilities through specified mechanisms. Structuration, historical sociology, and morphogenesis make explicit the possibility that action can reproduce or modify the conditions of subsequent action.

These inheritances also impose limits. Process does not by itself establish emergence; emergence does not by itself establish generativity; path dependence does not imply irreversible lock-in; recursive reproduction does not imply that every structure is internally self-transforming; and transformation of conditions does not require a relation-only ontology. A later generative relational analysis must therefore specify which entities and relations persist, which processes reproduce them, where novelty enters, how historical inheritance constrains later possibilities, and whether a transformation changes only outcomes or also the conditions through which subsequent outcomes are generated. Section 2.10 provides the intellectual genealogy for those questions while leaving their GRE-specific formulation to later chapters.

## 2.11 Social Facts and Relational Reality

The preceding sections established intellectual resources for thinking about relation, process, emergence, and historically conditioned transformation. The present section turns to a further question that becomes unavoidable once these resources are brought into the social domain: how can facts, rules, classifications, offices, norms, and institutions be socially constituted while remaining sufficiently real to organize conduct, distribute powers, and generate durable consequences? Its role is genealogical and differentiating. The discussion reconstructs several traditions that approach this problem through distinct concepts: Durkheimian social facts; the sociology of knowledge and institutionalization; philosophical accounts of institutional facts; pragmatist and practice-theoretic accounts of habit; theories of social norms; legal positivist accounts of legal validity; institutional analyses of governance rules; and theories of symbolic power and reflexive social causation. The five subsections distinguish social facts; culture, habit, and norm; legal and governance facts; symbolic stabilization and causal effect; and the historical revisability of social reality. The purpose is to clarify the conceptual materials available to later GR analysis without

treating every socially constituted phenomenon as the product of one mechanism.

### 2.11.1 Social Facts

The concept of a social fact provides one of the classical points of departure for a social ontology that refuses to reduce collective reality to the psychology of isolated individuals. In *The Rules of Sociological Method*, Durkheim defines social facts through their relative exteriority to the individual, their generality within a social group, and their capacity to exercise constraint (Durkheim 1982). Language, law, moral rules, monetary practices, occupational expectations, and other socially inherited forms confront a newly situated individual as already organized patterns. Their existence is expressed through individual conduct, yet they are not exhausted by any one individual's beliefs or actions. Durkheim's methodological injunction to treat social facts as things was designed to secure sociology an object of inquiry whose causes and functions could be investigated at the social level.

Durkheim's formulation makes persistence and constraint analytically central. A language remains available even when particular speakers enter or leave a population; a legal rule remains socially operative despite disagreement by particular subjects; a custom can exert pressure precisely because individuals encounter it as already established. The position should not be interpreted as claiming that social facts exist independently of all human practice. Durkheim's point concerns their relative independence from particular individual manifestations and the explanatory inadequacy of reducing them to individual intentions. The resulting lineage is therefore especially important for later theories that need to explain how social forms can be reproduced through persons while confronting those persons as conditions not of their own individual making.

Berger and Luckmann reconstruct this problem through the sociology of knowledge rather than through Durkheim's methodological vocabulary. *The Social Construction of Reality* analyzes everyday reality through processes of habitualization, institutionalization, objectivation, legitimation, and socialization (Berger and Luckmann 1966). Repeated conduct can become typified; reciprocal typifications can stabilize into institutions; institutions can confront later participants as an objective social order; and socialization can make that order subjectively meaningful. Their account is therefore explicitly temporal. What appears to later participants as an already existing social reality can have been produced through earlier interaction and subsequently transmitted in forms that no single current participant designed.

The distinction between objective and subjective social reality in this tradition is consequential. "Objective" does not mean independent of human history in the sense of a mountain or a chemical element. It refers to the way institutionalized meanings, roles, and expectations acquire a socially objectivated existence that individuals must interpret and navigate. Conversely, social reality remains dependent on continuing processes of enactment, legitimation, transmission, and internalization. Berger and Luckmann thereby provide a vocabulary for explaining how socially produced reality can become experienced as given without assuming that its historical production makes it fictitious.

Searle approaches institutional reality through analytic philosophy. In *The Con-*

*struction of Social Reality*, he distinguishes brute facts from forms of social and institutional fact that depend on collective intentionality or acceptance, representation, and constitutive rules (Searle 1995). Institutional facts concern such phenomena as money, property, offices, citizenship, promises, and games. Their relevant functions cannot be derived from physical structure alone. A material object can count as currency, a person can count as an officeholder, or an utterance can count as a promise within a system of collectively recognized statuses and rules. Searle's later vocabulary of status functions and deontic powers emphasizes that institutional statuses can create rights, duties, permissions, obligations, and authorizations.

These three lineages should remain distinct. Durkheim emphasizes social exteriority, generality, and constraint. Berger and Luckmann emphasize the historical production, objectivation, legitimation, and internalization of everyday institutional reality. Searle focuses on the logical and representational constitution of institutional facts, especially status functions sustained by collective acceptance. Their objects overlap, but their explanatory questions differ. A rule can be Durkheimianly constraining, Berger–Luckmannianly institutionalized, and Searleanly constituted through status recognition without those descriptions being theoretically equivalent.

A first foundation for later relational analysis follows from this plurality. Social reality can possess forms of persistence and causal relevance that are neither reducible to a single individual's current mental state nor independent of social relations altogether. The problem is therefore not resolved by choosing between “real” and “constructed.” Existing theory already provides several ways to explain how socially constituted facts can become stable objects of orientation, expectation, obligation, and action. The more difficult questions concern the mechanisms by which different kinds of social fact are produced, maintained, coupled, and transformed.

### 2.11.2 Culture, Habit, and Norm

The vocabulary of social facts becomes analytically sharper when culture, habit, and norm are distinguished. These concepts frequently interact in practice, yet they designate different objects. Culture can refer to historically transmitted repertoires of meaning, classification, symbolization, evaluation, and practice. Habit concerns acquired dispositions and recurrent modes of conduct. Norm refers more specifically to standards or expectations through which conduct is evaluated, anticipated, encouraged, or sanctioned. Theoretical traditions differ over each term, and a lineage-first account should resist converting them into interchangeable layers of one model.

Dewey gives habit a strongly social and environmental interpretation. In *Human Nature and Conduct*, habits are acquired modes of conduct that depend on the cooperation of organism and environment; customs and social conditions participate in their formation and maintenance (Dewey 1922). A habit is therefore more than a private repetition stored inside an individual. Walking depends on a physical environment, speech on linguistic and social surroundings, and moral dispositions on patterns of interaction and expectation. Dewey's treatment is valuable because it makes habit both stabilizing and revisable. Habits enable coordinated conduct by carrying prior learning into present situations, while changed conditions, conflicting habits, and reflective inquiry can reorganize them.

Bourdieu's theory of practice develops a different account of socially formed disposition. In *Outline of a Theory of Practice*, the concept of habitus addresses durable and embodied dispositions generated under historically structured conditions and implicated in the production of practice (Bourdieu 1977). Habitus is not simply a list of consciously followed rules. It provides practical orientations, classifications, expectations, and embodied tendencies through which agents navigate fields without calculating every action from first principles. Because dispositions are formed through differentiated social trajectories, patterned conduct can be reproduced without requiring identical explicit beliefs across all participants.

This practice-theoretic lineage also complicates simple accounts of culture. Cultural competence is not exhausted by propositions that actors can state. Accent, gesture, taste, timing, bodily ease, classifications of what is appropriate, and expectations regarding institutions can be socially learned and practically operative without being fully explicit. Bourdieu's later work on symbolic power further emphasizes that linguistic and classificatory practices operate within unequal social conditions rather than within a neutral space of shared meaning (Bourdieu 1991). A cultural form can therefore be both meaningful and structured by differential authority to name, classify, certify, and have classifications recognized.

Norm theory identifies another mechanism. Bicchieri's *The Grammar of Society* analyzes social norms through the expectations that sustain compliance and through the conditions under which norms emerge, become salient, and change (Bicchieri 2006). This approach makes it possible to distinguish a norm from mere behavioral regularity. A population can behave similarly because members share material constraints, because they have acquired similar habits, because they expect others to behave in a certain way, because they believe others expect a particular conduct from them, or because formal sanctions attach to deviation. These mechanisms can coexist, but their coexistence should be demonstrated rather than assumed.

The distinction also clarifies the relation between custom and norm. A repeated practice may become habitual without acquiring a strongly articulated normative status. Conversely, a norm can remain normatively recognized while frequently violated. Culture can provide the symbolic vocabulary through which a norm becomes intelligible, while habit can make compliant conduct practically easy. Institutional sanctions can reinforce the same pattern from another direction. Social stability often results from such coupling, which explains why apparently simple regularities may be difficult to change: different mechanisms can support the same observable conduct.

These lineages establish a useful caution for economic and institutional analysis. Observable regularity is an insufficient basis for inferring one underlying social mechanism. A queue, a dress convention, a professional credential, a pattern of household labor, a market convention, or a bureaucratic routine can involve habits, norms, classifications, sanctions, strategic expectations, and material constraints in different proportions. The concepts of culture, habit, and norm therefore provide distinct analytical resolutions for explaining why conduct becomes patterned and why some patterns persist even when individuals could physically act otherwise.

For later GR work, the important inheritance is methodological rather than doctrinal. Theories of habit and practice show how past social relations can become em-



bodied dispositions; norm theory shows how expectations and social evaluation can stabilize conduct; theories of symbolic power show that meaning-making capacities are unequally distributed. A generative account may later ask how these mechanisms condition one another across time, but Chapter 2 should first preserve the conceptual differences through which existing theory has made those questions visible.

### 2.11.3 Legal Facts and Governance Facts

Law provides an especially clear case in which socially constituted facts can have precise practical consequences. Whether a statute is valid, a person holds an office, a contract exists, an agency possesses jurisdiction, or a procedure has been properly completed cannot usually be determined from physical description alone. Such facts depend on rule-governed practices, recognized sources, procedures, offices, and interpretive communities. Jurisprudence and institutional analysis therefore supply an important bridge between social ontology and the organized distribution of authority.

Hart's *The Concept of Law* analyzes a developed legal system through the union of primary and secondary rules (Hart 2012). Primary rules impose obligations, while secondary rules concern recognition, change, and adjudication. The rule of recognition occupies a distinctive position because it supplies criteria used by officials to identify legally valid rules. Its existence is itself a matter of social practice rather than legal validity established by a still higher legal rule. Hart's account therefore makes the existence of a legal order depend in part on shared official practices and an internal orientation toward rules as standards, while allowing the validity of particular legal rules to be determined through institutional criteria.

This analysis demonstrates a form of layered social fact. The fact that a legislature enacted a statute may depend on constitutional rules identifying the legislature, procedural rules governing enactment, evidentiary practices establishing that required acts occurred, and a rule of recognition identifying the relevant sources of law. Legal reality is consequently structured by relations among rules rather than by isolated commands. A legal fact can be highly determinate within an institutional system even though the system's foundational practices are historically contingent social facts.

Searle's theory of institutional facts offers a complementary vocabulary. A legal office, property title, authorization, or obligation can be analyzed as involving collectively recognized status functions and deontic powers (Searle 1995). The advantage of this framework is that it draws attention to the way institutional statuses alter what agents are entitled, required, or empowered to do. A physical person and an office-holder can be materially the same individual while occupying different normative positions. The institutional status reorganizes relations of authorization and obligation among that person and others.

Institutional analysis broadens the inquiry beyond formal law. Ostrom's *Understanding Institutional Diversity* studies institutions through action arenas, rules used by participants, community attributes, and the conditions under which institutional arrangements operate and change (Ostrom 2005). This perspective directs attention toward rules-in-use and recurrent governance practices rather than assuming that formally promulgated law exhausts the institutional order. A community, firm, pro-



fessional body, platform, or resource-management arrangement can possess meaningful governance structures whose operation depends on conventions, monitoring practices, procedures, and shared understandings alongside formal legal rules.

The phrase *governance fact* is used here as an organizing label for this broader class of socially constituted facts concerning authorized roles, jurisdiction, procedures, decision competence, rule applicability, and recognized outcomes. It is not presented as a canonical category shared by Hart, Searle, or Ostrom. The label helps distinguish, for example, the legal fact that a statute is valid from the governance fact that a particular committee is treated as the competent body for a decision under an organization's operative practices. The two may coincide, but informal institutions and organizational procedures can create governance facts that are not straightforwardly reducible to state law.

This distinction also prevents the category of social fact from becoming analytically flat. A greeting convention, a property title, a constitutional office, and an informal resource-allocation rule can all be socially constituted while differing in formalization, sanction, documentation, jurisdiction, and revision procedure. Legal systems characteristically develop specialized secondary rules and authoritative institutions for identifying and changing legal facts. Other governance arrangements may rely more heavily on custom, reputation, repeated interaction, or organizational procedure. The existence of a socially recognized rule therefore does not by itself establish its legal status.

For later relational economic analysis, jurisprudence and institutional theory provide two indispensable insights. First, authority and obligation are structured through relations among rules, offices, procedures, and recognized actors rather than through material capability alone. Second, changing a rule can change the relational positions from which later actions are possible: who may decide, who may challenge, what counts as evidence, which resources can be allocated, and which procedures confer validity. These insights will later matter for power and governance, but the present chapter uses them primarily to establish the intellectual foundations of socially constituted yet practically consequential institutional reality.

#### **2.11.4 Symbolic Stabilization and Causal Effect**

Social construction is sometimes misunderstood as implying causal weakness. The lineages reconstructed above support almost the opposite conclusion. A socially constituted classification or status can have durable effects precisely because actors, organizations, legal systems, and infrastructures orient their conduct around it. The relevant causal question is therefore how symbolic distinctions become stabilized, connected to resources and sanctions, reproduced in practice, and incorporated into expectations.

Berger and Luckmann's account of objectivation and legitimation is one starting point. Institutional meanings become more durable when they are typified, transmitted, justified, and incorporated into broader symbolic orders (Berger and Luckmann 1966). A role is easier to reproduce when participants possess names and expectations for it; an institution becomes more resilient when its procedures are taught and justified; and a social classification can become part of everyday reality when

it is embedded in routine interactions and socialization. Symbolization in this sense helps coordinate interpretation across persons and generations.

Bourdieu adds the problem of unequal symbolic authority. *Language and Symbolic Power* treats linguistic exchange as embedded in social relations in which speakers possess unequal capacities to have utterances recognized as legitimate, authoritative, official, or valuable (Bourdieu 1991). Symbolic efficacy therefore depends on social conditions of recognition. Naming, certification, classification, and public declaration can reorganize conduct when the speaker or institution possesses recognized authority and when the relevant audience inhabits a field in which the classification has practical meaning.

Legal and institutional facts illustrate this mechanism especially clearly. A judicial judgment, a property register, a professional license, a central-bank declaration, or an organizational appointment consists partly of symbolic acts and representations. Yet their consequences can include transfer of assets, restriction of liberty, access to markets, eligibility for benefits, or authority over organizational resources. Searle's account of status functions emphasizes this connection between collectively recognized representation and deontic power (Searle 1995). The symbolic and material dimensions are therefore analytically distinguishable but often causally coupled.

Merton's analysis of the self-fulfilling prophecy provides a different mechanism through which representation can become causally consequential. A definition or expectation can influence conduct in ways that contribute to producing the condition that participants anticipated (Merton 1948). The mechanism does not imply that every belief creates its own truth. It identifies a particular feedback structure in which socially consequential expectations alter behavior and thereby affect outcomes. Bank runs, reputational dynamics, and coordination processes offer familiar classes of cases in which expectations can participate in generating the conditions to which they refer, although each empirical case requires mechanism-specific investigation.

Institutional economics adds further precision by connecting rules to incentives and uncertainty. North defines institutions as humanly devised constraints that structure interaction and emphasizes their role in shaping incentives and long-run economic performance (North 1990). This account differs from Searle's social ontology and from Bourdieu's theory of symbolic power, yet it reinforces a common analytical point: institutionalized rules and classifications matter because they alter feasible actions, expected returns, transaction environments, and strategic relationships. The causal efficacy of an institution is mediated through behavior and organizational arrangements rather than through the mere semantic content of a rule.

These traditions therefore support a distinction among several routes from symbol to consequence. A representation can constitute an institutional status; a classification can coordinate expectations; a recognized authority can impose a binding designation; a norm can trigger approval or sanction; an expectation can change behavior in a self-reinforcing direction; and a formal rule can restructure incentives and permissible actions. Symbolic stabilization is strongest when several of these routes reinforce one another, but the mechanisms should remain separately identifiable.

This is also where the term *relational reality* begins to acquire a disciplined social

meaning. A socially constituted fact can be real for analysis when it is embedded in relations that reliably reorganize conduct, obligation, access, expectation, or resource distribution. Such a claim does not require treating every social representation as true, just, or equally efficacious. Nor does it require reducing the material world to discourse. It requires tracing the relations through which symbolic and institutional forms become causally consequential within a historically situated social order.

### 2.11.5 Historical Revisability of Social Reality

The stability of social facts creates a final theoretical problem: socially constituted reality can confront actors as durable and objective while remaining historically revisable. A satisfactory account must therefore explain both persistence and transformability. If social reality were freely revisable by individual belief, the concepts of institution, law, norm, and social fact would lose much of their explanatory force. If it were immutable, its social and historical constitution would become unintelligible.

Berger and Luckmann's institutional account already contains this temporal tension. Institutions are sedimented through habitualization, reciprocal typification, legitimation, and socialization, yet they remain products of ongoing social processes (Berger and Luckmann 1966). The same mechanism that makes an institution appear objective to later participants also explains why its continued existence requires transmission and reproduction. Historical durability therefore arises from successful reproduction across changing populations rather than from metaphysical permanence.

North's institutional analysis likewise treats institutions as both constraints and objects of change. Formal rules, informal constraints, and enforcement arrangements can persist because they organize incentives and expectations, while institutional change alters those same structures over time (North 1990). The path-dependent analysis developed in the preceding section adds that revision is rarely costless. Established organizations, sunk investments, legal precedents, learned routines, and distributions of bargaining power can make some institutional trajectories easier to continue than to reverse.

Historical sociology sharpens the possibility of discontinuous revision. Sewell's theory of structure and events shows how schemas and resources can be reproduced through ordinary practice yet transformed through consequential sequences that reorganize later action (Sewell 1992; Sewell 1996). Giddens similarly emphasizes the recursive relation between practices and the rules and resources reproduced through them (Giddens 1984). These traditions differ over how structure and agency should be analytically separated, but both reject an image of social structure as a timeless container external to practice.

Hacking's historical ontology adds an epistemic and classificatory dimension. His work examines how categories, concepts, and styles of reasoning can have histories that alter what can be described, investigated, and sometimes lived as a kind of person or social object (Hacking 2002). The relevance to social facts lies in the possibility that classificatory practices do more than describe an independently fixed social world. In some domains, changing classifications can alter institutions, self-

understandings, administrative procedures, and patterns of action, thereby changing the very phenomena subsequently classified.

Legal and governance facts make revisability especially visible because many institutions contain explicit procedures for their own alteration. Hart's secondary rules of change identify legal mechanisms through which valid rules can be introduced, amended, or removed (Hart 2012). Ostrom's institutional analysis likewise directs attention toward the rules through which participants organize and revise governance arrangements (Ostrom 2005). Social orders can therefore institutionalize transformation itself: the constitution of an authorized revision procedure becomes part of the reality whose future states that procedure can modify.

This recursive feature helps clarify why the concepts reconstructed in Section 2.11 matter for later GR. Existing theory already shows that social reality can be generated historically, objectivated, embodied as habit, stabilized through norms, constituted through legal and institutional rules, reinforced through symbolic authority, and revised through practice and explicit procedures. A later generative relational analysis can build on these lineages by asking how such mechanisms interact and how one socially constituted relation changes the conditions under which other relations can emerge, persist, or disappear. That later question should not erase the distinctions established here.

Several conceptual guardrails follow from the genealogy. Socially constituted does not mean arbitrary. Symbolically mediated does not mean causally inert. Habit does not mean norm. Norm does not mean law. Legal validity does not exhaust governance practice. Institutional stability does not imply historical irreversibility. Causal efficacy does not imply moral legitimacy. These distinctions allow social facts to be treated as historically generated and relationally sustained without reducing them either to private belief or to natural necessity. They also preserve the ontological suspension required by this book: the reality of a social fact can be investigated through its relations of recognition, reproduction, constraint, authorization, representation, and consequence without requiring a final metaphysical claim about what social reality ultimately is.

## 2.12 Primitive Structure of Social Dynamics

The preceding sections reconstructed theories of relation, process, emergence, and socially constituted reality. The present section asks a more elementary question: which conceptual distinctions have repeatedly been required when social theory attempts to describe how a configuration becomes different, how patterned organization persists, and how some possibilities are enabled while others are restricted? Its role is genealogical and preparatory. Rather than deriving a complete ontology of social dynamics, the section reconstructs established treatments of change, difference, structure, and constraint and then relates those concepts to a wider descriptive vocabulary of states, relations, entities, properties, processes, and events. These traditions do not converge on one metaphysics. Aristotle, process philosophy, structuralism, theories of practice, information-oriented approaches, institutional analysis, and analytic event ontology assign different status to the same terms. Their juxtaposition

nevertheless clarifies why later GR can treat change, difference, structure, and constraint as a deliberately minimal analytical vocabulary while withholding the claim that any one of them is an ultimate constituent of reality.

### 2.12.1 Change

Change is among the oldest organizing problems of philosophy because any account of persistence, causation, action, or history must explain how something can become otherwise while remaining sufficiently identifiable for the change to be described. Aristotle's *Physics* provides a classical framework by analyzing motion and change through such distinctions as actuality and potentiality, form and matter, and different kinds of alteration (Aristotle 2018). Its relevance here is the durable analytical problem it establishes: description requires both some dimension along which a transformation occurs and some account of the continuity that permits one to say that a transformation has occurred to, in, or through a relevant subject.

Modern process philosophies alter the priority among these terms. Bergson's account of duration resists treating temporality as a succession of externally juxtaposed instants and instead emphasizes qualitative becoming (Bergson 1911). Whitehead goes further by developing a metaphysics in which process and event-like becoming are more fundamental than enduring substance (Whitehead 1929). Dewey's naturalism places change within organism–environment transactions and treats relatively stable forms as accomplishments within ongoing activity rather than as the opposite of process (Dewey 1925). Mead similarly makes the emergent present central to temporality and argues that a consequential novelty can reorganize the significance attributed to the past (Mead 1932). These positions differ markedly, but each makes it harder to regard change as a secondary disturbance imposed on an otherwise fully static world.

Social theory adds a further complication because the object that changes may partly consist in practices that reproduce it. Giddens's theory of structuration describes social systems as recursively produced through practices in which rules and resources are both conditions and outcomes of action (Giddens 1984). Sewell reformulates structure through schemas and resources and gives transformation a more explicit place in the theory, especially when events reorganize relations among them (Sewell 1992; Sewell 1996). Archer, by contrast, insists on analytical separation across time: structural and cultural conditioning precede interaction, interaction can produce elaboration or reproduction, and later agents confront conditions partly transformed by prior cycles (Archer 1995). The three traditions therefore share an interest in social transformation while disagreeing about how structure and agency should be separated analytically.

These lineages also show why change should not be identified with improvement, novelty, or eventfulness. Reproduction across time is itself a temporal achievement. A norm can remain similar because it is continuously reenacted; an institution can persist because actors repeatedly perform the work required for maintenance; a hierarchy can reproduce itself through changing personnel; and a relation can remain stable while its material supports are replaced. Conversely, a visible event may leave the generative conditions of a system largely intact. Social analysis therefore needs



a concept of change broad enough to include variation in state, relation, organization, capacity, rule, and trajectory, while leaving the substantive significance of that variation open to investigation.

This point is important for the later GR vocabulary. A primitive concept of change need not presuppose what kind of thing is changing. It can refer provisionally to a detectable or inferable transformation between configurations, while the appropriate ontology of the configuration remains unsettled. Such minimality prevents the analysis from assuming in advance that change must belong to an already constituted individual, institution, relation, or field. The stronger question—what kind of reality is transformed, by what mechanism, and with what consequences for subsequent transformation—can then be addressed at a later analytical stage.

### 2.12.2 Difference

A description of change requires some way of distinguishing what differs. Difference, however, has several theoretical meanings. It can indicate simple non-identity between observations, a contrast produced within a classificatory system, a difference that carries information for an observer or system, or a more fundamental principle of differentiation through which identities themselves become determinate. The intellectual history of the concept therefore spans logic, linguistics, anthropology, cybernetics, and metaphysics.

Saussure's linguistics provides one influential account of differential determination. In the linguistic system, the value of a sign depends on contrasts within a structured field rather than on an isolated intrinsic content possessed independently of other signs (Saussure 1966). This insight became foundational for structuralist approaches well beyond linguistics. The transferable lesson is narrower: some identities are intelligible only through systems of difference. A status, category, office, or classification may acquire determinate meaning partly because it occupies a position contrasted with other available positions.

Bateson's work offers a different route. His essays on communication, cybernetics, learning, and epistemology repeatedly treat pattern and difference as central to information and response (Bateson 2000). Here a physical difference becomes analytically consequential when it enters a circuit of discrimination, communication, or response. The emphasis therefore shifts from mere non-identity to consequential difference. This is especially useful for social inquiry because societies contain innumerable physical, symbolic, and behavioral variations, only some of which become recognized, encoded, institutionally relevant, or causally effective within a particular relation.

Deleuze radicalizes the philosophical status of difference in another direction. *Difference and Repetition* criticizes traditions in which difference is conceptually subordinated to prior identity and develops a metaphysics in which differential processes participate in the genesis of identities themselves (Deleuze 1994). GR does not need to inherit this metaphysical commitment in order to take the problem seriously. The lineage demonstrates that difference can be treated either as comparison among already constituted terms or as part of the process through which determinate terms arise. Those are different theoretical claims and should not be conflated.



In social analysis, difference can therefore be present at several levels. Two observed states may differ statistically. Two institutional positions may be differentiated by rule. Two actors may become socially distinguished through classification. A difference in access may generate a difference in later capability. An initially minor asymmetry may be amplified through cumulative advantage. Conversely, a physically measurable difference may remain socially inert because no relevant practice, institution, perception, or mechanism responds to it. Difference is thus neither automatically meaningful nor automatically causal.

This distinction also clarifies why difference should remain separate from inequality. Inequality is a normatively and substantively more specific relation concerning unequal quantities, positions, powers, opportunities, burdens, or valuations. Difference is analytically prior only in the weak sense that an inequality requires some relevant distinction or comparison. The presence of difference alone establishes neither hierarchy nor injustice. A later normative analysis must therefore identify which differences become socially organized, how they are evaluated, and through what mechanisms they affect life chances, recognition, value, or power.

For later GR, the concept can consequently remain minimal: difference marks a non-equivalence, distinction, gradient, contrast, or differentiation relevant to a specified analysis. The theory must then establish whether the difference is observed, represented, institutionally constituted, causally consequential, normatively salient, or generative of further differences. This keeps the primitive open enough to travel across empirical domains without converting every difference into the same kind of social fact.

### 2.12.3 Structure

The concept of structure addresses patterned organization. Its attraction lies in the possibility that the properties of a social configuration cannot be explained adequately by listing its elements independently. Yet “structure” has carried sharply different meanings across intellectual traditions. It can denote a system of relations among elements, a rule-governed transformation system, a relatively enduring distribution of positions and resources, or the recursively reproduced conditions of practice. A genealogical reconstruction is therefore necessary before the concept can function as a primitive.

Structural linguistics supplied one influential model. Saussure’s differential conception of language made the value of an element dependent on its position within a system (Saussure 1966). Lévi-Strauss extended structural analysis into anthropology, especially through kinship, myth, classification, and symbolic organization, seeking relations and transformations beneath the immediately observed diversity of cultural forms (Lévi-Strauss 1963). The structuralist move shifts explanatory attention from isolated units toward patterns among positions, oppositions, and transformations. Its limits are equally important: a structural description can illuminate organization while giving inadequate attention to historical genesis, agency, contingency, or the mechanisms by which a structure changes.

Piaget’s *Structuralism* provides a useful metatheoretical formulation because it characterizes structure through the linked ideas of wholeness, transformation, and

self-regulation (Piaget 1970). Structure in this sense is more than an inventory of components. The elements belong to an organized whole whose transformations are governed by relations internal to the system. Although Piaget develops this formulation across mathematics, psychology, biology, and the human sciences, it does not follow that social structures literally possess the same formal properties as mathematical structures. The importance of the lineage lies in distinguishing structure from mere aggregation.

Practice theory and historical sociology rework the concept in ways more directly relevant to social dynamics. Giddens defines structure through rules and resources recursively implicated in the reproduction of social systems, making structure both enabling and constraining rather than an external framework standing outside action (Giddens 1984). Sewell criticizes parts of this formulation while retaining the emphasis on duality; his account treats structures as mutually sustaining schemas and resources whose transposability and multiplicity create possibilities for both reproduction and transformation (Sewell 1992). Archer rejects the collapse of structure and agency into one recursive moment and insists that temporally prior structural conditions possess emergent properties capable of conditioning later interaction (Archer 1995). These disagreements reveal that “structure” is not one settled object.

A useful minimal concept must therefore avoid importing an entire structuralist or structuration-theoretic ontology. At the level required here, structure can designate patterned organization among distinguishable elements, positions, relations, or transformations such that the organization matters for what can occur next. This formulation leaves several questions open: whether the structure is material, symbolic, institutional, networked, legal, or mixed; whether it is represented explicitly by participants; whether it is stable or transient; whether it is reproduced through action; and whether its explanatory relevance lies in topology, rules, resources, meanings, or some other feature.

The minimality also helps distinguish structure from relation. A relation can connect two or more terms without by itself constituting a larger organized pattern. Structure concerns an arrangement of relations, positions, distinctions, or transformation rules whose organization is analytically consequential. Conversely, a structure need not be represented adequately by a static network of pairwise ties. Legal orders, classification systems, role systems, and temporal routines may possess structure whose relevant organization includes higher-order rules, sequences, or interpretive dependencies. Later GR can therefore ask how structures emerge from relations and how structures condition the generation of later relations without assuming that the two concepts are interchangeable.

#### 2.12.4 Constraint

Constraint identifies a further feature of social dynamics: not every logically imaginable transition is equally available. Theories of constraint differ over whether restrictions arise from physical conditions, institutions, norms, distributions of resources, inherited structures, cognition, or strategic interdependence. They also differ over whether constraint should be understood negatively as limitation or more broadly

as the patterned specification of a space of possible action.

Durkheim's social facts offer a classical social-scientific starting point. Social facts are recognizable partly through the external constraint they can exercise over individuals (Durkheim 1982). Law, moral regulation, language, custom, and collective expectations confront persons as conditions they did not individually create. Durkheim's formulation established constraint as a mark of social reality. Read too mechanically, however, it can encourage an image of structure acting externally upon an already constituted individual. Later theories consequently attempt to explain how constraint can be reproduced through practice or embodied in disposition.

Giddens explicitly treats structure as both constraining and enabling. Rules and resources do not merely block action; they make coordinated forms of action possible while organizing the conditions under which those actions occur (Giddens 1984). Bourdieu's habitus provides another route because historically formed dispositions shape practical expectations and perceived possibilities without requiring actors to consult an explicit rule at every moment (Bourdieu 1977). Archer again insists on temporal separation: structural and cultural properties can predate a particular action situation and condition the interests and opportunities of agents, even though later interaction may transform those conditions (Archer 1995). These accounts all reject a simple equation between constraint and direct coercion.

Institutional economics makes the concept more explicit in another register. North defines institutions through humanly devised constraints that structure interaction and thereby shape incentives and uncertainty (North 1990). Ostrom's institutional analysis gives greater attention to the specific rules-in-use through which participants organize action situations and to the diversity of institutional arrangements that can be constructed and revised (Ostrom 2005). Legal theory likewise shows that a rule can constrain by defining validity, authority, permission, obligation, and competence rather than by physically preventing alternatives (Hart 2012). Constraint can therefore operate through several mechanisms: exclusion, cost, sanction, authorization, expectation, classification, capability, procedural requirement, or the absence of a necessary resource.

The distinction between constraint and determination is crucial. A constraint narrows, shapes, redirects, or differentially prices possibilities without necessarily selecting one unique outcome. The same legal rule can generate different behavior across organizational contexts; the same resource shortage can produce adaptation, conflict, exit, substitution, or failure; the same norm can be obeyed, evaded, contested, or transformed. Social constraints are frequently conditional upon interpretation, enforcement, position, and the availability of alternatives. Their analysis therefore requires specification of mechanism and scope.

Constraint should also remain distinct from normativity. A constraint can be unjust, beneficial, neutral, or normatively ambiguous. Likewise, a normative commitment can guide conduct without operating as an effective social constraint when it lacks recognition, enforcement, embodiment, or institutional support. The analytical task is first to identify which possibilities are restricted or enabled for whom, through what relation, and over what timescale. Normative evaluation comes later.

For later GR, a minimal concept of constraint can thus refer to a condition that alters the feasible, probable, intelligible, permissible, or sustainable transitions available within a configuration. This definition is deliberately plural. Material scarcity, institutional rules, informational asymmetry, historical dependence, embodied disposition, and network position may all constrain, but they need not do so in the same way. Treating constraint as primitive therefore does not eliminate causal analysis; it creates a place in which heterogeneous limiting and enabling conditions can be investigated without prematurely reducing them to one ontology.

### 2.12.5 States, Relations, Entities, Properties, Processes, and Events

The four concepts reconstructed above do not exhaust the vocabularies through which social dynamics are described. Empirical and theoretical work routinely speaks of entities, properties, states, relations, processes, and events. Section 2.2 introduced these categories ontologically; the present subsection clarifies their role within a dynamic analytical vocabulary. The central point is that they can be treated as different descriptive resolutions rather than as mutually exclusive claims about the final furniture of the social world.

Entity language identifies relatively bounded units. Persons, firms, organizations, states, households, platforms, contracts, or assets may be treated as entities when their continuity is sufficient for the research task. Property language attributes characteristics to such units or configurations. Armstrong's theory of states of affairs provides one metaphysical example in which particulars, properties, and relations combine in structured facts (Armstrong 1997). Social research usually requires a weaker commitment: an entity and its properties can be treated as analytically stable where doing so preserves the distinctions needed for explanation, even when the entity's internal constitution remains relational and historically variable.

State language provides a cross-sectional description of a configuration at a specified analytical time. A state may summarize properties, relations, resource distributions, legal statuses, expectations, or other variables judged relevant to subsequent change. The usefulness of a state description depends on resolution. Two situations can be represented as the same state under one model while differing substantially under another because the second representation retains distinctions suppressed by the first. State identity is therefore partly a representational achievement, not simply a transparent reading of reality.

Relation language describes connections, dependencies, obligations, contrasts, exchanges, recognitions, or other linkages among terms. The philosophy-of-relation lineage reconstructed in Section 2.9 showed why relation may be external, internal, constitutive, higher-order, or structurally embedded without those possibilities being equivalent. Within a dynamic vocabulary, relations can themselves be states of connection that form, persist, intensify, weaken, or dissolve. A relation can also modify the properties or capacities attributed to its terms, which is why an exclusively entity-centered representation may miss economically consequential constitution.

Process language shifts attention from snapshots toward temporally extended activity. Whitehead's process metaphysics represents an especially strong version of this shift, but process need not carry that metaphysical burden in social inquiry

(Whitehead 1929). Institutionalization, learning, accumulation, bargaining, socialization, technological adoption, and organizational change can be analyzed as processes when their temporal organization matters to the explanation. A process can include many events and intermediate states while retaining enough continuity to be treated as one unfolding trajectory for a particular purpose.

Event language identifies occurrences sufficiently localized to matter as transformations within such trajectories. Davidson's event ontology is influential because it treats events as particulars capable of entering causal relations and of being described under different vocabularies (Davidson 2001). Social and historical inquiry need not inherit Davidson's full theory to use the distinction. A strike, election, merger, judicial decision, default, discovery, policy announcement, encounter, or organizational failure can function as an event when its occurrence marks a consequential transition. Sewell's historical sociology adds the important reminder that some events become historically significant because they transform the structures through which later action is organized, whereas many occurrences remain comparatively routine (Sewell 1996).

These categories are therefore cross-cutting. An entity can occupy a state; a state can include properties and relations; a process can transform states; an event can be represented as a localized transition within a process; a relation can itself persist as an entity-like object for legal or administrative purposes; and an event can alter the properties through which an entity is subsequently identified. The categories are useful precisely because they permit different resolutions of the same historically changing configuration.

The genealogy developed in this section makes possible a restrained GR synthesis. The quartet of change, difference, structure, and constraint is a later GR compression of recurring analytical problems distributed across Aristotle, structuralism, process philosophy, institutional economics, theories of practice, and other lineages reviewed here. It should therefore be presented as an inherited and reorganized vocabulary rather than attributed retroactively to any single predecessor. Change registers transformation; difference registers non-equivalence and differentiation; structure registers patterned organization; constraint registers the conditioning of possible transitions. States, relations, entities, properties, processes, and events then provide richer descriptive forms that can be constructed when the empirical object requires them.

Calling the four terms *primitive* should therefore be understood methodologically rather than metaphysically. They are starting distinctions chosen to postpone stronger ontological assumptions. Their status remains analytical and provisional, leaving the composition of ultimate reality under ontological suspension. In later GR, stable entities, relations, subjects, institutions, values, and fields may be reconstructed through configurations in which change, difference, structure, and constraint become mutually organized and historically persistent. Chapter 2 establishes only why such a move is intellectually available. Whether the resulting vocabulary is adequate must be tested through later ontological, methodological, empirical, and economic analysis.

Several guardrails follow. Change does not imply progress. Difference does not imply inequality. Structure does not imply stasis. Constraint does not imply deterministic closure. A state is not the same object as the reality it represents. An entity



need not be metaphysically self-sufficient. A relation need not eliminate relata. A process need not exclude relatively stable units. An event need not be historically transformative. Preserving these distinctions allows a minimal dynamic vocabulary to remain plural enough for social inquiry while preparing the more explicit GR account of ontological emergence developed in later chapters.

## 2.13 Subject Formation in Relational Systems

Theories of social reality require some account of the beings who perceive, act, interpret, occupy positions, receive recognition, and become objects of classification within that reality. The present section reconstructs established approaches to subject formation and asks how they have explained the emergence and persistence of socially situated subjecthood without assuming that all traditions mean the same thing by *subject*, *self*, *person*, *identity*, or *actor*. Its role in the chapter is preparatory. Symbolic interactionism, recognition theory, theories of ideology and subjectification, dramaturgical sociology, practice theory, narrative accounts of selfhood, critical realism, and relational sociology each isolate different mechanisms through which subjects become socially intelligible and consequential. The discussion proceeds from relational stabilization and recognition to subject positions, causal persistence, representation, and competing ontological interpretations. The objective is to clarify the inherited conceptual resources from which a later GR account can be constructed while preserving the unresolved question of how much of subjecthood is constituted by social relations and how much must remain irreducible to them.

### 2.13.1 Subjecthood and Relational Stabilization

A major lineage in modern social theory treats selfhood as something that develops within social interaction rather than as a fully formed interior substance that merely enters into relations after its constitution. George Herbert Mead provides one of the clearest formulations. In *Mind, Self, and Society*, the self emerges through the social process in which an individual learns to take the attitudes of others and, at a more organized level, the standpoint of the generalized other (Mead 1934). The self is therefore socially mediated from the beginning of its specifically reflexive form. Mead's distinction between the "me" and the "I" also prevents this account from becoming a theory of simple social determination. The "me" incorporates organized social attitudes, whereas the "I" names the response that cannot be fully specified in advance by those attitudes. Social formation and novelty are consequently internal to the same account.

Berger and Luckmann develop a different but compatible problem-space through socialization, institutionalization, and the internalization of socially objectivated meanings (Berger and Luckmann 1966). Their analysis emphasizes how a social world that was historically produced by human activity can confront later participants as an objective reality and become internalized through primary and secondary socialization. Subject formation in this account cannot be separated from the acquisition of typifications, roles, vocabularies, legitimations, and taken-for-granted expectations through which a social world becomes intelligible. The socially



formed subject is therefore situated within a reality that precedes the individual biography even though that reality itself has a historical origin.

Bourdieu's theory of practice relocates the problem from explicit internalization toward embodied disposition. *Habitus* designates durable and transposable dispositions formed under structured conditions and subsequently implicated in perception, judgment, and practice (Bourdieu 1977). Its importance for subject formation lies in the way past social conditions can become practically sedimented without requiring continuous conscious calculation. A person learns how to move, anticipate, distinguish, value, and respond within a field through historically formed dispositions. This does not imply that conduct is mechanically programmed. Bourdieu's account is precisely concerned with practical improvisation generated from dispositions whose history may remain partly opaque to the actor.

Giddens approaches subject formation through the recursive organization of practices. Agents draw upon rules and resources in the production of conduct, while the same practices participate in reproducing the social systems within which later conduct occurs (Giddens 1984). Routine is especially significant because continuity of self and continuity of social relations can be supported through recurrent practical organization. Subjecthood here is connected to knowledgeable agency and reflexive monitoring, yet it is exercised under conditions that the actor neither chooses in full nor comprehends exhaustively.

These approaches share a rejection of the image of an entirely pre-social subject, but they should not be treated as equivalent. Mead develops a social account of reflexive selfhood through symbolic interaction. Berger and Luckmann emphasize socialization into objectivated institutional worlds. Bourdieu theorizes embodied dispositions and practical sense. Giddens analyzes knowledgeable agency within recursively reproduced systems. Each therefore identifies a different mechanism through which social relations can become stabilized within subjectivity and action.

Margaret Archer supplies an important counter-position to any inference that social mediation exhausts subjecthood. In *Being Human*, Archer distinguishes the emergence of self-consciousness and personal identity from the later acquisition of social identity, arguing that embodied practical engagement with the natural and practical orders is not reducible to linguistic or social constitution (Archer 2000). Social roles and relations matter greatly, but the person cannot be analytically dissolved into role occupancy or discursive position. This disagreement is foundational for the present chapter. A relational account of subject formation can range from the claim that some dimensions of selfhood are socially mediated to the much stronger claim that subjecthood is constituted through social relations all the way down. Existing theory does not settle that transition.

The literature therefore provides several senses of relational stabilization. A subject can become relatively stable because organized attitudes are internalized, because institutional meanings are learned, because dispositions become embodied, because routines are reproduced, or because roles and commitments acquire continuity across time. Stability in these traditions is an accomplishment of processes rather than evidence of an unchanging essence. At the same time, Archer's critique shows why stabilization within social relations need not establish that every property of the person has a social origin. This unresolved boundary becomes central

once recognition and subject position are introduced.

### 2.13.2 Social Recognition and Subject Position

Theories of recognition ask how a person's relation to self and social standing depend on responses from others. Honneth reconstructs a recognition-theoretic lineage in which forms of socially mediated self-relation develop through relations of recognition, while experiences of disrespect or misrecognition can motivate social conflict (Honneth 1995). His later discussion of social invisibility sharpens the distinction between being physically perceived and being socially acknowledged as a person whose presence makes a normative claim on others (Honneth 2001). Recognition is therefore more than information about another individual. It concerns a relation through which socially consequential standing is affirmed, denied, or damaged.

The concept of a *subject position* develops through different theoretical traditions. Althusser's theory of ideology describes interpellation as a process through which ideology addresses individuals as subjects within already organized social meanings and practices (Althusser 2001). The importance of the argument lies in the reversal of a familiar picture. The individual is not first a fully constituted subject who subsequently adopts an ideology; ideological practices participate in producing the forms in which individuals recognize themselves and are recognized as subjects. Interpellation is consequently a theory of subject constitution through ideological structure rather than a general theory of interpersonal recognition.

Foucault develops another account in which the subject is formed within relations of power and practices of subjectification. In "The Subject and Power," he distinguishes modes through which human beings are made subjects and places individualization within historically specific power relations (Foucault 1982). The term *subject* carries a double implication in this lineage: a person may be subject to another through control and dependence while also being tied to an identity through knowledge of the self. Power is therefore productive as well as restrictive because it participates in forming capacities, classifications, conduct, and self-relations. Foucault's account also preserves the possibility of resistance, since a power relation presupposes acting subjects whose responses are not completely predetermined.

Butler's analysis of gender adds a further mechanism. *Gender Trouble* criticizes the idea that gendered identity simply expresses a prior stable substance and develops an account in which identity is sustained through reiterated social performances and norms (Butler 1990). The significance for subject formation is broader than any one identity category: repetition can produce the appearance of stability while simultaneously leaving room for variation, failure, displacement, and contestation. A socially recognizable subject position can therefore have real persistence without requiring an invariant essence underneath its repeated enactment.

These theories should remain analytically separated. Honneth focuses on normative relations of recognition and the formation of practical self-relation. Althusser theorizes ideological interpellation. Foucault investigates historically specific modes of subjectification through power and knowledge. Butler analyzes the performative reiteration of identity norms. Their vocabularies sometimes overlap around constitution, recognition, and social intelligibility, but they assign different mechanisms,

normative implications, and degrees of agency to the process.

The distinction between subjecthood and subject position follows from this plurality. A subject position can refer to a socially available location from which a person becomes classified, addressed, authorized, constrained, or expected to act. Examples include legal person, citizen, debtor, patient, student, employee, parent, expert, refugee, or consumer. Theories of interpellation and subjectification make such positions central because socially organized categories can precede particular occupants. Recognition theory, by contrast, emphasizes relations through which persons acquire or lose socially consequential standing. The concepts intersect when recognition is mediated through positions, but neither reduces cleanly to the other.

This literature also explains why subject formation can be unequal. Access to valued positions, credibility, rights, authority, visibility, and recognition can be differentially distributed. A person can occupy a formally recognized role while being denied informal recognition; conversely, a socially meaningful identity can persist without formal legal codification. Institutional status, interpersonal recognition, ideological address, and embodied practice can therefore stabilize different dimensions of subjecthood at different rates. Later analysis requires mechanisms specific enough to identify which dimension is operating.

### 2.13.3 Causal Persistence and Relational Reality

A theory of socially formed subjects must explain why a subject position can remain consequential beyond a single moment of interaction. The issue is not persistence in a metaphysical sense alone. Social analysis also concerns the persistence of causal consequences: whether a role, classification, disposition, or recognized standing continues to shape later possibilities even when the immediate interaction that produced or activated it has ended.

Practice theory provides one route. Bourdieu's habitus explains how historically formed social conditions can persist through embodied dispositions that continue to orient action across situations (Bourdieu 1977). Giddens locates continuity in recurrent practices and the reproduction of rules and resources (Giddens 1984). Berger and Luckmann emphasize institutional objectivation and socialization, through which historically produced meanings become available as relatively durable social facts (Berger and Luckmann 1966). In each case, persistence is relationally supported, yet the carrier of persistence differs: disposition, recurrent practice, institutionalized meaning, or some combination of them.

Archer's treatment of roles adds a useful distinction between an occupant and a social position. Roles can pre-exist particular occupants, outlast them, and possess powers of constraint and enablement that are not reducible to the personal characteristics of whoever currently fills the role (Archer 2000). A professorship, judicial office, licensed profession, or organizational position can therefore remain causally consequential while its occupants change. The persistence of the role does not imply that occupants are interchangeable in every respect. It means that some causal properties belong to the organized position and its relations rather than to the biography of a particular person.

Institutional theories provide closely related resources. Searle's analysis of status

functions shows how collectively recognized status can generate deontic powers, including rights, duties, permissions, and obligations, that change what an individual can socially do (Searle 1995). Hart's legal theory similarly shows that a rule-governed office or legal status can have consequences because it is embedded within a wider practice of recognition and secondary rules (Hart 2012). These accounts make it possible to say that a socially constituted subject position can be causally real without assuming that its reality is physically intrinsic to the person who occupies it.

Relational sociology generalizes the problem. Emirbayer argues for conceiving social entities through dynamic, unfolding relations rather than treating actors as self-sufficient substances whose properties are fully specifiable independently of relational processes (Emirbayer 1997). This approach does not require denying the existence of actors. It changes the explanatory question by asking how boundaries, capacities, preferences, identities, and causal powers are produced or transformed through transactions and relations. The resulting subject may have persistence, but that persistence must be explained through the organization and reproduction of relations rather than assumed as a primitive property.

Classification adds another form of causal persistence. Hacking's historical ontology emphasizes that categories used to classify people can be historically made and can interact with the people classified (Hacking 2002). Once institutionalized, a classification can organize records, eligibility, treatment, expectations, self-understanding, or research. Its effects may therefore persist through administrative and epistemic infrastructures even when particular acts of classification are no longer visible. The socially constituted category becomes consequential because practices, documents, institutions, and persons continue to respond to it.

These literatures allow a limited but important conclusion. Social constitution and causal reality are compatible. A status, role, identity category, or subject position can be historically contingent and relationally sustained while producing durable consequences. This conclusion does not determine the ontology of the subject itself. It establishes only that causal persistence cannot be inferred solely from material intrinsicness, and social construction cannot be inferred to mean causal unreality. The specific mechanisms of persistence remain an empirical and theoretical question.

#### **2.13.4 Symbolized and Represented Subjects**

Subjects become socially consequential partly through representations. Names, records, credentials, profiles, diagnoses, classifications, narratives, reputations, legal documents, demographic categories, and institutional files make persons legible to others and to organizations. Existing theory has approached this symbolic dimension from several directions, each of which distinguishes the living subject from the representations through which social systems encounter that subject.

Mead's account already contains a representational moment because reflexive selfhood depends on significant symbols and the capacity to take the attitude of others toward oneself (Mead 1934). The self becomes an object to itself within symbolic interaction. Yet Mead does not reduce the self to a fixed representation: the "I" remains the response to organized attitudes, and the social process continues. Representation is therefore constitutive of reflexivity without exhausting the activity of the subject.

Goffman's dramaturgical sociology shifts attention to situated presentation. In *The Presentation of Self in Everyday Life*, participants manage impressions before audiences and employ expressive practices to sustain a socially intelligible definition of the situation (Goffman 1959). The presented self is neither simply fraudulent nor a transparent revelation of an inner essence. It is an interactional accomplishment governed by setting, audience, role, expectations, and the practical requirements of maintaining a performance. Different settings can consequently stabilize different presentations of the same person.

Ricoeur's hermeneutics of selfhood adds a temporal dimension. *Oneself as Another* treats personal and narrative identity as related problems and investigates how selfhood is articulated through action, narration, responsibility, and interpretation (Ricoeur 1992). Narrative can connect heterogeneous events within a biography and make continuity intelligible without requiring identity to mean complete sameness across time. This provides an important alternative to both a purely substantial self and a purely external social label: representation can participate in the temporal organization of self-understanding.

Sociological critique of the term *identity* further warns against allowing representation to become analytically total. Brubaker and Cooper argue that identity has been asked to perform too many explanatory tasks and propose more differentiated concepts such as identification, categorization, self-understanding, commonality, connectedness, and groupness (Brubaker and Cooper 2000). Their intervention is especially important for subject formation because a category assigned by a state, an identity claimed by a person, a sense of commonality, and an externally attributed group membership can diverge. Using one word for all of them can conceal the relations that require explanation.

Representations can also alter the subjects they represent. Hacking's work on classifications makes this feedback explicit: categories of people can enter practices and self-understandings, while responses by classified persons can in turn transform the category (Hacking 2002). Foucault's analyses similarly show how knowledge practices and institutional classifications participate in modes of subjectification (Foucault 1982). Symbolic representation is therefore capable of becoming causally active when linked to institutions, expertise, sanctions, opportunities, recognition, or self-interpretation.

This literature supports several distinctions that later analysis should preserve. A subject is not identical to a record of the subject. Self-understanding is not identical to external categorization. A performed role is not identical to the entirety of the person performing it. Narrative continuity is not equivalent to institutional persistence. A representation can nevertheless participate in producing the conditions under which a subject acts and is acted upon. The analytical task is therefore to investigate the relation between subject, representation, audience, institution, and subsequent response rather than treating representation as either transparent description or mere illusion.

The contemporary expansion of machine-readable profiles gives these established problems new empirical scope without changing their basic philosophical structure. When access to credit, employment, education, insurance, welfare, communication, or visibility is mediated through data representations, institutions may act upon a



represented subject whose operational profile differs from the person's own self-description or lived continuity. Chapter 2 need not supply a new theory of digital subjecthood to identify the lineage of the problem. Goffman, Hacking, Foucault, Ricoeur, and Brubaker and Cooper already provide distinct resources for separating presentation, classification, narration, subjectification, and identification.

### 2.13.5 Subjecthood under Ontological Suspension

The reconstructed traditions do not yield a single ontology of the subject. Mead treats reflexive selfhood as emerging within social process. Berger and Luckmann foreground socialization into institutional reality. Bourdieu emphasizes embodied dispositions. Honneth gives recognition a constitutive role in practical self-relation. Althusser and Foucault examine subject constitution through ideology and power. Butler emphasizes reiterated norm-governed performance. Ricoeur develops a hermeneutics of selfhood and narrative identity. Archer argues that embodied selfhood and personal identity possess properties that cannot be reduced to social identity. Emirbayer shifts explanation from substantial entities toward relational processes without simply eliminating actors. The disagreements concern more than vocabulary. They concern what a subject is, how it persists, which capacities are socially constituted, and what remains irreducible to social relations.

Ontological suspension provides a way to use these resources without prematurely adjudicating every metaphysical disagreement. A social inquiry may need to represent a person as an embodied organism in one analysis, a legal person in another, a role incumbent in another, a bearer of dispositions in another, a narrating self in another, a classified population member in another, or a participant in a changing network of relations. These descriptions can sometimes refer to the same human being while selecting different properties and causal mechanisms. Their coexistence does not establish that they are interchangeable descriptions of one already settled ontology.

This position also protects against two opposite reductions. The first treats subjecthood as entirely self-contained and regards social relations as external influences on a pre-formed person. The second treats the person as nothing more than the sum of socially assigned positions, discourses, or representations. Existing theory supplies strong reasons to question both extremes. Mead, Honneth, Foucault, Butler, Bourdieu, and relational sociology show how deeply social relations can enter the formation of socially intelligible subjects. Archer and phenomenological traditions reviewed in Section 2.7 preserve dimensions of embodiment, practical engagement, finitude, and lived continuity that resist easy reduction to recognized social position.

The same restraint applies to persistence. A subject may persist biologically while losing a role, persist narratively through major institutional change, retain a legal identity despite transformed social recognition, or remain represented in administrative systems after the relations that originally generated the representation have changed. Conversely, the same institutional role can persist through many occupants. Subject persistence therefore cannot be treated as a single variable until the analytical object has been specified.

A later GR framework can inherit this plurality by treating subjecthood as a prob-



lem of formation, stabilization, transformation, and relational consequence while suspending stronger claims about ultimate ontology. The relevant questions then concern how particular forms of subjecthood become possible, what relations support them, which representations mediate them, what powers or constraints become attached to them, how they persist, and how they are transformed. Such questions are compatible with relational analysis without requiring the thesis that a subject is exhausted by relations.

The genealogical result of the section is therefore limited but consequential. Modern social theory has already established multiple mechanisms through which subjects can be socially formed: symbolic interaction, socialization, embodied disposition, recognition, ideological address, power, normative reiteration, role occupancy, institutional status, narrative interpretation, classification, and relational process. It has also generated strong objections to reducing humanity to any one of those mechanisms. This unresolved field supplies the theoretical foundation for GR to study generative relations of subject formation while retaining distinctions among person, subject, role, identity, representation, and position. The task for the later theory is to specify when these dimensions align, when they diverge, and how their relations participate in generating subsequent social and economic possibilities.

## 2.14 Value, Valuation, and Plural Forms of Value

Theories of social reality and subject formation become economically consequential when they address what persons, institutions, and communities treat as worth pursuing, preserving, exchanging, comparing, or refusing to compare. The present section reconstructs major intellectual lineages concerning value and valuation before the later chapters turn to ethics, political economy, allocation, exploitation, welfare, and generative value. Its objective is conceptual clarification rather than the construction of a unified theory of value. Philosophical axiology, pragmatism, economics, epistemology, aesthetics, environmental thought, and the sociology of valuation use the vocabulary of value for different analytical problems. The discussion therefore proceeds from the distinction between value and valuation to intrinsic, instrumental, and relational formulations; domain-specific forms of value; processes of value formation and transformation; and debates over pluralism, commensurability, and incomparability. The method is genealogical and comparative. Existing theories carry the explanatory burden, while the final synthesis identifies a limited set of questions that later GR and GRE can inherit without treating heterogeneous traditions as interchangeable.

### 2.14.1 Value and Valuation

The word *value* can designate a property attributed to an object, a relation between an object and a valuer, a reason for action, an evaluative standard, a socially recognized form of worth, or an outcome of practical appraisal. The word *valuation* directs attention toward the activity or process through which something comes to be appraised, ranked, cherished, priced, authorized, or rejected. The distinction is analytically useful because a theory can accept that some things are valuable without

explaining how agents recognize or institute their value, while another theory can study practices of valuation without committing itself to the proposition that value is exhausted by those practices.

G. E. Moore's *Principia Ethica* provides a canonical analytic attempt to treat goodness as irreducible and to distinguish intrinsic value from the natural properties with which goodness may be associated (Moore 1903). Moore's project is important here because it exemplifies a value-theoretic orientation in which the principal problem concerns what is good and in virtue of what it is good. The evaluative property is not identified with an observable act of appraisal. This orientation differs markedly from pragmatist and sociological accounts in which valuation is approached as situated conduct.

John Dewey's *Theory of Valuation* shifts the emphasis toward the practical formation and appraisal of ends (Dewey 1939). Dewey analyzes desires, interests, ends-in-view, and judgments of value within situations in which conduct encounters difficulty and consequences become objects of reflection. Valuation is therefore connected to inquiry into the conditions and consequences of action. Ends do not function simply as fixed termini supplied independently of experience; they can be examined and revised in light of what their pursuit produces. This pragmatist formulation makes valuation temporally extended and experimentally revisable while avoiding the inference that every value judgment is merely an arbitrary report of preference.

The sociology of valuation introduces another level of analysis. Lamont surveys work in which valuation and evaluation involve social practices of categorization, legitimation, comparison, and the organization of multiple orders of worth (Lamont 2012). From this perspective, it matters who is authorized to evaluate, which criteria become legitimate, how evaluative devices are institutionalized, and how actors learn the repertoires through which persons and objects are judged. Valuation is consequently distributed across people, classifications, organizations, instruments, conventions, and fields. A prize committee, credit-rating system, peer-review process, market price, professional credential, and intimate attachment all perform evaluative work, but they do so through different procedures and with different consequences.

Economic reasoning supplies still another vocabulary. Classical political economy already distinguished different senses of economic value and their relations to exchange, labor, scarcity, and price. Smith's contrast between value in use and value in exchange, for example, identifies a problem that cannot be resolved merely by equating usefulness with market exchange ratios (Smith 1776). Marx later places the value form of commodities within a historically specific system of social production and exchange, thereby treating economic value as connected to social relations rather than as a free-standing natural property of objects (Marx 1867). Later marginalist and neo-classical traditions will reformulate the problem through utility, preference, scarcity, and marginal choice; those developments are treated in their proper place later in this chapter. At this stage, the historical point is sufficient: economic thought has never possessed a single uncontested meaning of value.

These traditions therefore isolate different questions. Moore asks about the character of goodness. Dewey asks how valuation operates within practical inquiry. Sociology investigates the social organization of evaluative practices. Political econ-

omy asks how economically consequential forms of value arise within production, exchange, and social order. The distinctions matter because *value*, *valuation*, *price*, *preference*, *utility*, and *worth* cannot be treated as synonyms without losing the theoretical problems each vocabulary was designed to address.

### 2.14.2 Intrinsic, Instrumental, and Relational Value

A long-standing problem in value theory concerns whether something is valued for its own sake, for what it enables, or through the character of a relation in which it participates. The familiar distinction between intrinsic and instrumental value is useful, but its apparent simplicity can conceal several different philosophical distinctions. Korsgaard's analysis is especially important because it separates the intrinsic–extrinsic distinction from the final–instrumental distinction (Korsgaard 1983). Something may be valued as an end while its value still depends on relations, interests, or conditions outside the object considered in isolation. The claim that a good is non-instrumental therefore does not by itself establish that its value is intrinsic in the stronger sense of being independent of external relations.

Moore's account offers one influential version of intrinsic value, in which the value of a whole or state of affairs is examined independently of its usefulness as a means (Moore 1903). Instrumental value, by contrast, concerns contribution to another valued end. The distinction has obvious practical importance: a medicine may be valued because it restores health; money may be valued partly because it enables acquisition; and a scientific instrument may be valuable because it expands observational capacity. Yet instrumental analysis becomes inadequate where the mode of relation to a good partly constitutes what is valuable about it. Friendship, political membership, care, scientific understanding, or attachment to a landscape can be distorted if they are described only as interchangeable means to separately specified satisfactions.

Anderson develops a pluralist account in which different goods can call for different modes of valuation and can be realized through different social relations (E. Anderson 1993). Love, respect, use, admiration, and market exchange do not simply represent different quantities of one evaluative attitude. The mode in which something is valued can itself matter to the good. A relationship treated solely through market exchange may therefore be transformed even if the same material resources continue to circulate. Anderson's argument is especially important for later economic analysis because it makes the social form of valuation part of what must be evaluated rather than an ethically neutral container for a fixed underlying good.

The contemporary environmental literature on *relational values* provides a more specific use of relational vocabulary. Chan and colleagues argue that environmental valuation is inadequately captured by an exclusive opposition between instrumental value to humans and intrinsic value in nature, because many commitments concern appropriate relationships, responsibilities, identities, and forms of living well with human and nonhuman others (Chan et al. 2016). Their concept should not be generalized automatically into a universal theory of relational value. It belongs to a particular interdisciplinary debate in environmental thought and policy. Its importance for the present genealogy lies in demonstrating that evaluative significance may attach to the quality and appropriateness of a relationship rather than solely to an isolated

object or to the object's usefulness for another end.

The threefold vocabulary of intrinsic, instrumental, and relational value therefore does not form a single settled taxonomy across philosophy, economics, and environmental studies. Intrinsic value can mean value independent of consequences, value independent of external relations, or value possessed for its own sake, depending on the theory. Instrumental value may concern causal means, enabling conditions, or exchangeable resources. Relational value may refer to value constituted by a particular relation, value realized through a relation, or a normative commitment concerning how one ought to relate. Careful analysis requires specifying which claim is intended.

This distinction also guards against a premature relational reduction. The observation that some values depend upon relations does not establish that all value is relational in the same sense. A later GR framework may investigate how evaluative properties, subjects, and relations become co-constituted, but Chapter 2 need only establish that existing value theory already supplies multiple ways in which the location of value can be understood: in objects or states of affairs, in consequences, in modes of regard, in practical relations, or in historically organized forms of life.

### 2.14.3 Epistemic, Aesthetic, Ethical, and Economic Value

The plurality of value becomes clearer when different domains of evaluation are considered. Epistemic, aesthetic, ethical, and economic values can interact within the same practice, yet each domain has developed criteria and problems that resist immediate translation into the others. The distinction does not imply sealed spheres. Its purpose is to prevent a single evaluative vocabulary from silently absorbing standards that arose for different objects and purposes.

Epistemic value concerns goods associated with inquiry and cognition. The traditional problem of the value of knowledge asks why knowledge should be regarded as more valuable than true belief or other epistemically successful states. Kvanvig reconstructs this problem and gives particular importance to understanding as an epistemic achievement whose value may not be captured by simply counting true propositions (Kvanvig 2003). The problem is therefore evaluative as well as definitional: epistemology must specify what makes a cognitive state worth seeking. Longino adds a social dimension by showing that scientific inquiry is shaped by constitutive and contextual values and that objectivity depends upon organized critical interaction rather than the disappearance of every value from inquiry (Longino 1990). Epistemic evaluation can consequently concern truth, justification, reliability, explanatory understanding, critical scrutiny, openness to revision, and the organization of inquiry.

Aesthetic value has an equally complex genealogy. Kant's analysis of judgments of beauty treats aesthetic judgment as irreducible to mere agreeableness or straightforward conceptual determination, while still involving a claim that reaches beyond purely private liking (Kant 1987). Dewey relocates aesthetic value within temporally organized experience in which doing and undergoing acquire a consummatory form (Dewey 1934). Bourdieu, in turn, demonstrates that aesthetic judgments and tastes are socially differentiated and implicated in classed histories of cultural competence and distinction (Bourdieu 1984). These accounts differ sharply concerning the philosophical standing and social formation of aesthetic judgment, but together they make

clear that aesthetic value cannot safely be translated into market demand or individual pleasure without substantial theoretical loss.

Ethical value concerns goods, reasons, duties, virtues, forms of life, and relations that enter judgments about how persons ought to act or what is worth promoting and respecting. Moore's intrinsic-goodness project is one classical analytic approach; Anderson's pluralist account emphasizes different modes of valuing and the social relations through which goods are properly realized (Moore 1903; E. Anderson 1993). Sen's critique of the separation of economics from ethics further shows that economic assessment inevitably touches questions concerning well-being, agency, freedom, and the evaluative information regarded as relevant (Sen 1987). Ethical value therefore cannot be reduced in advance to the satisfaction of given preferences, even though preference satisfaction may remain one relevant consideration in some contexts.

Economic value has been theorized through several historically distinct frameworks: usefulness and exchange, labor and social production, marginal utility, preference, scarcity, willingness to pay, opportunity cost, and monetary price are among the major vocabularies. Smith and Marx already illustrate how different the objects called *value* can be within political economy (Smith 1776; Marx 1867). Later neoclassical theory narrows and formalizes particular evaluative relations for the analysis of choice and allocation, while welfare economics asks how individual evaluations can be related to social assessment. These traditions will receive dedicated treatment later. The present section requires only one guardrail: *economic value* should not be used as an unqualified synonym for *price*. Prices are socially consequential evaluative signals and coordination devices, but the existence of a price neither proves that all relevant value has been represented nor establishes that everything of value should be priced.

The domains also overlap. Scientific inquiry can be aesthetically admired, economically funded, ethically constrained, and epistemically evaluated at the same time. A forest can have market value, ecological significance, aesthetic importance, sacred meaning, and relational value within a community. A university can be valued for earnings effects, knowledge production, civic formation, status, beauty of intellectual achievement, and personal transformation. Such coexistence does not itself settle whether the values are commensurable. It establishes a prior point: social objects and practices can participate simultaneously in several evaluative orders whose criteria differ.

This multidimensionality is important for GRE because economic organization can alter non-economic values even where no explicit conversion was intended. A pricing device can change patterns of attention; an incentive can transform the meaning of an activity; a classification can affect dignity; an efficiency gain can alter epistemic diversity; a market can expand access while changing the social relation through which a good is provided. Chapter 2 does not yet judge such transformations. It establishes the intellectual basis for recognizing that economic valuation takes place within a wider field of heterogeneous value.

### 2.14.4 Value Formation and Transformation

If values were fixed properties transparently recognized by isolated subjects, the principal analytical task would be measurement. Several traditions instead make value formation itself an object of inquiry. Dewey's pragmatist account is foundational because ends and valuations can be reorganized through experience, inquiry, and reflection on consequences (Dewey 1939). What agents care about, how they formulate ends, and which consequences they treat as relevant can change through participation in problematic situations. Valuation therefore has a history within conduct.

Bourdieu supplies a different mechanism through habitus, field, and socially differentiated taste. Evaluative dispositions are formed through durable histories of position and practice, making judgments that appear immediate partly dependent upon embodied social trajectories (Bourdieu 1984). The sociology of valuation generalizes the analytical attention to social processes through categorization, legitimation, evaluative repertoires, institutional gatekeepers, and devices of comparison (Lamont 2012). Values and rankings can stabilize because organizations, professions, educational systems, markets, and cultural fields repeatedly enact criteria of worth.

Economic valuation illustrates how evaluative devices can participate in producing the object they claim merely to measure. Fourcade's comparison of environmental damage valuation analyzes the reasons for monetary valuation, the techniques through which monetary translations are produced, and the feedback from assigned monetary values into social practices and representations (Fourcade 2011). The lesson is broader than environmental economics. A valuation procedure can select relevant attributes, establish equivalences, create categories, authorize experts, and make a particular representation actionable. Once institutionalized, the resulting valuation may influence later behavior and thereby alter the environment in which subsequent valuations occur.

This feedback does not imply that evaluators can create arbitrary value without resistance from material conditions, other actors, legal rules, established meanings, or competing evaluative orders. Social valuation is constrained as well as productive. A market appraisal can fail to attract a buyer; a ranking can lose legitimacy; a scientific criterion can be rejected under new evidence; an aesthetic canon can be contested; a moral category can become politically unacceptable. Value transformation is therefore better understood as historically conditioned reorganization than as free symbolic invention.

The distinction between valuation and value also becomes important over time. A new valuation device can change what is visible and comparable before it changes deeper commitments. Conversely, a transformation in collective commitments may precede the development of institutions capable of representing those values. Monetary, legal, aesthetic, epistemic, and moral valuations can move at different speeds. Their interaction may produce reinforcement, conflict, conversion, or insulation. A community may refuse to monetize a sacred object while assigning it extensive legal protection; a research institution may value open inquiry while using bibliometric measures for allocation; a household may purchase care services without regarding care itself as exhausted by its price.

Existing literature therefore makes possible a dynamic conception of valuation



without requiring a single theory of where value ultimately resides. Values can be learned, embodied, articulated, priced, classified, institutionalized, contested, and revised. Evaluative criteria can also become objects of evaluation. Later GR can build on this inheritance by asking how relations among subjects, institutions, representations, and evaluative practices generate conditions for subsequent valuation. That later question should remain distinct from the historical claim established here: long before GR, pragmatist and sociological traditions had already made the formation and transformation of value a legitimate theoretical object.

#### 2.14.5 Value Pluralism and Incommensurability

Value pluralism concerns the possibility that there are multiple genuine forms of value that cannot be reduced to a single master good without remainder. Incommensurability and incomparability concern more specific problems of comparison. These ideas are related but should not be identified. Several values may be plural yet commensurable under a contextually accepted metric; two options may be difficult to compare without belonging to fundamentally different value domains; and the absence of a common cardinal scale does not automatically imply that rational comparison is impossible.

Raz's account of value pluralism treats significant incommensurability as a feature of a social world containing multiple valuable forms of life and commitments (Raz 1986). Incommensurable options cannot always be represented as one being better, worse, or exactly equal to another on a single ordering. The philosophical literature collected by Chang develops the problem further by examining commensurability, comparability, indeterminacy, and practical reason as distinguishable issues (Chang 1997). The importance of this debate for economic inquiry is immediate. A decision problem may remain reason-governed even where values resist translation into one homogeneous quantity.

Anderson's pluralist theory approaches the issue through different modes of valuation and kinds of goods (E. Anderson 1993). The question becomes not only how much a good is valued, but how it is appropriately valued. Respect, affection, use, admiration, and market exchange may constitute different relations to goods and persons. A common monetary metric can therefore be practically useful while remaining normatively incomplete. Sen similarly criticizes informational narrowing in economic evaluation and reconnects economics with questions of agency, freedom, and ethical assessment (Sen 1987). These approaches differ, but both challenge the assumption that evaluative plurality can always be represented without loss through a single scalar measure.

Sociology adds an institutional dimension to commensurability. Espeland and Stevens define commensuration as the comparison of different entities according to a common metric and analyze it as a consequential social process (Espeland and Stevens 1998). Metrics do not merely reveal pre-existing comparability. They can change attention, suppress distinctions, create new equivalences, and redistribute authority. Commensuration is therefore simultaneously cognitive and political. The capacity to establish a metric, decide which attributes count, and determine acceptable trade-offs can become a form of power.

This point is essential for later GRE analysis because economic systems continuously perform conversions: labor into wages, environmental effects into damages, knowledge into intellectual property, reputation into creditworthiness, attention into advertising revenue, education into credentials, and heterogeneous projects into ranked funding portfolios. Some conversions are indispensable for coordination. Others produce losses, exclusions, or changes in meaning. The existence of conversion does not prove full commensurability, and the practical necessity of decision does not establish that every relevant value has been captured by the chosen metric.

A careful vocabulary can therefore distinguish at least four situations. Values may be directly commensurable under a shared measure; they may be comparable through qualitative judgment without a common cardinal unit; they may be only partially comparable under context-specific conventions; or they may resist an accepted comparison for the decision at hand. Which situation obtains is itself an empirical, interpretive, and sometimes normative question. It should not be decided merely by the availability of a numerical representation.

The lineages reconstructed in this section leave a clear but limited foundation for later GR and GRE. Existing philosophy already distinguishes intrinsic, instrumental, final, relational, and plural forms of value. Pragmatism makes valuation situated and revisable. Epistemology, aesthetics, ethics, and economics disclose different evaluative objects and standards. Sociology shows how valuation, ranking, and commensuration are institutionally organized and historically consequential. Political and moral philosophy demonstrates that plurality need not collapse into a complete common ranking. Later GRE can therefore investigate heterogeneous value, conversion, circulation, return, capture, dissipation, and regeneration while treating the conditions and limits of commensuration as substantive objects of analysis. That programme remains downstream from the genealogy. The inherited literatures establish why the problem of plural value is intellectually available while leaving open which values exist, how they should be ordered, and which conversions are justified.

## 2.15 Ethics, Justice, and Nomos

Theories of value become normatively consequential when they address how agents ought to act, which social arrangements can be justified, how persons should stand in relation to one another, and how normative orders acquire authority while remaining open to criticism and change. The present section reconstructs several major lineages in ethics, theories of justice, procedural fairness, relational equality, social norms, jurisprudence, and the idea of *nomos*. Its objective is to clarify the conceptual resources that make later GR and GRE discussions of normative judgment, justice, institutional order, and normative transformation possible. The discussion proceeds from normativity and ethical judgment to justice and social order, procedural and relational justice, norm formation and *nomos*, and the revisability of normative orders. The method is genealogical and comparative. Existing theories carry the explanatory burden, while the final synthesis identifies a limited set of unresolved questions that later GR can inherit without treating distinct moral, legal, and political traditions as interchangeable.

### 2.15.1 Normativity and Ethical Judgment

Normativity concerns standards under which actions, reasons, institutions, characters, or states of affairs can be assessed as required, permitted, justified, admirable, wrong, unfair, or otherwise evaluatively answerable. Ethical judgment is one mode through which such standards are applied, interpreted, contested, or revised. Neither term names a single philosophical doctrine. Major ethical traditions differ over the object of judgment, the source of normative authority, the role of character and consequences, and the relation between practical reasoning and social life.

Aristotle's *Nicomachean Ethics* provides a classical account in which ethical inquiry is inseparable from the cultivation of character, practical wisdom, habituation, and a conception of human flourishing (Aristotle 2014). Ethical judgment is therefore not reducible to the mechanical application of universal rules. The practically wise person must discern what a situation requires under conditions in which action is particular, context-sensitive, and shaped by cultivated dispositions. Justice enters Aristotle's account both as a virtue and as a problem of proportion, distribution, and rectification. The importance of this lineage for the present chapter lies in its treatment of ethical competence as historically and socially cultivated practical judgment rather than as a detached calculation performed by an otherwise unchanged chooser.

Kant's moral philosophy provides a markedly different foundation. In the *Groundwork of the Metaphysics of Morals*, moral obligation is connected to autonomy, the categorical imperative, and the requirement to treat humanity as an end rather than merely as a means (Kant 2012). The authority of morality is not grounded in the contingencies of desire, social convention, or expected consequences. Kant therefore supplies a powerful deontological lineage in which ethical judgment concerns whether a maxim can satisfy a principle of universal practical reason and whether action respects persons as bearers of moral status. This differs sharply from Aristotelian virtue ethics, even though both traditions reject the reduction of ethics to the aggregation of immediate preferences.

Scanlon's contractualism relocates a central part of morality within the relation of mutual justification. On his account, judgments of right and wrong concern principles for the general regulation of behavior that others could not reasonably reject (Scanlon 1998). The significance of this approach is relational in a specific normative sense: moral requirements are connected to what persons owe one another and to the possibility of justifying conduct to those affected by it. This should not be generalized into a complete theory of all value or all social relations. It supplies a distinctive account of interpersonal moral wrongness, reasons, responsibility, and justification.

Pragmatist approaches introduce another orientation. Dewey's theory of valuation treats evaluative judgment as situated within practical inquiry, where ends, means, and consequences can become objects of reflection and revision (Dewey 1939). Ethical judgment in this lineage is neither the passive recognition of timeless value-properties nor arbitrary preference expression. It develops within problematic situations and can be reconstructed when consequences disclose inadequacies in established ends or habits. The resulting normativity is experimental and fallibilist without being normatively empty.

These traditions make different elements of ethical judgment visible. Aristotle em-

phasizes cultivated practical discernment and character; Kant emphasizes autonomy and universal moral obligation; Scanlon emphasizes mutual justifiability; Dewey emphasizes situated appraisal and revisability. They should not be compressed into a single model of normative judgment. Their coexistence establishes a more limited point for Chapter 2: ethical judgment has long been theorized through different combinations of practical reasoning, character, universal principle, interpersonal justification, and reflective revision. Later GR can inherit the problem of how these forms of judgment become socially and historically possible without claiming that their normative validity is exhausted by the conditions of their emergence.

### 2.15.2 Justice and Social Order

Theories of justice extend normative inquiry from individual conduct toward institutions, distributions, rights, capabilities, forms of cooperation, and durable structures of social power. The relation between justice and social order is especially important because an order can be stable without being just, while a conception of justice must eventually address the institutions and relations through which persons actually live together. Political philosophy therefore distinguishes questions of social coordination from questions of normative justification even when the two are empirically intertwined.

Rawls's *A Theory of Justice* reoriented twentieth-century political philosophy by treating the basic structure of society as a primary subject of justice and by developing justice as fairness through the device of the original position (Rawls 1999). Principles are to be selected under conditions that abstract from morally arbitrary social position and natural advantage. The resulting theory gives priority to basic liberties and regulates social and economic inequalities through principles intended for free and equal citizens. Rawls therefore supplies a contractual and institutional theory in which justice concerns the organization of major social institutions rather than the moral quality of isolated transactions alone.

Sen's work shifts emphasis from a fully specified ideal arrangement toward comparative evaluation of freedoms, capabilities, agency, and actual injustice. His critique of informationally narrow economic reasoning and his capability-oriented approach emphasize what persons are effectively able to do and be, rather than treating resource holdings or utility as sufficient measures of advantage (Sen 1987; Sen 1999). This changes the informational basis of justice. Identical resources can generate different substantive opportunities because persons occupy different bodily, social, institutional, and environmental conditions. Justice assessment must therefore attend to conversion conditions as well as nominal allocations.

Young develops a different critique of distributive reductionism. *Justice and the Politics of Difference* argues that domination and oppression, the organization of decision making, the division of labor, cultural representation, and institutional exclusion can be justice-relevant even where the distribution of material goods is not the sole or most revealing object of analysis (Young 1990). This line of argument broadens justice from the allocation of divisible goods toward the structures and relations through which social positions, voices, capacities, and vulnerabilities are produced and maintained.

Recognition theory adds another dimension. Honneth analyzes social recognition as important to the development of practical self-relations and interprets forms of disrespect as normatively significant injuries (Honneth 1995). Recognition should not be treated as a substitute for distribution, legal rights, or institutional design. Its contribution is to make the quality of social relations themselves visible as a domain of normative assessment. A social order can allocate material resources while still organizing relations of humiliation, exclusion, subordination, or denial of standing.

These approaches therefore differ in their primary objects of justice. Rawls focuses on the basic structure and fair terms of cooperation; Sen emphasizes substantive freedoms and comparative justice; Young foregrounds domination and oppression; recognition theory investigates relations through which persons acquire or are denied social standing. Their differences prevent a single definition of justice from being assumed at the foundation of GRE. What they jointly establish is a richer field of possible justice-objects: distributions, capabilities, rights, institutional structures, decision procedures, social positions, relations of recognition, and the production of domination can all become normatively relevant under different theories.

For economic inquiry, this plurality matters because the same economic arrangement can appear differently under different informational and normative perspectives. A policy may improve aggregate income while diminishing substantive freedom for a particular group; a distribution may satisfy an allocative criterion while being sustained through relations of domination; a formally universal rule may reproduce unequal effective access; and a relationship can be materially advantageous while remaining humiliating or coercive. Chapter 2 does not adjudicate among these theories. It establishes why later GRE cannot treat justice as synonymous with either efficiency or distribution alone.

### 2.15.3 Procedural and Relational Justice

Justice can concern outcomes, procedures, and the relations among participants. These dimensions frequently interact but are analytically distinct. A favorable outcome can be produced by an objectionable procedure, while a fair procedure can yield an outcome that remains contestable under another theory of justice. Likewise, formally correct procedures can operate inside social relations structured by domination or unequal standing. The distinction between procedural and relational justice therefore adds resolution to the broader problem of social justice.

Rawls provides an influential philosophical vocabulary by distinguishing forms of procedural justice and by embedding procedures within a wider conception of justice as fairness (Rawls 1999). A procedure cannot be assessed in isolation from the background conditions that make its operation meaningful. The same formal rule can have different normative implications under different distributions of rights, opportunities, and institutional power. Procedure is therefore not simply the sequence of steps through which an outcome is reached; its fairness depends partly on the justice of the framework within which participants act.

Empirical procedural-justice research adds a different kind of evidence. Tyler's studies of legal authority show that perceptions of fair treatment, respectful interaction, neutrality, and opportunities for voice can affect legitimacy and voluntary defer-

ence independently of whether a person receives a preferred outcome (Tyler 2006). This literature does not by itself settle the philosophical question of what makes a procedure normatively just. It demonstrates that procedural experience has causal and legitimacy effects that an outcome-only model would miss. Institutions therefore govern not only by allocating results but also through the manner in which persons are heard, classified, addressed, and treated.

Relational theories of equality shift the object again. Anderson criticizes views of equality centered primarily on compensating persons for bad brute luck and instead develops democratic equality around the social relations appropriate among citizens who stand as equals (E. S. Anderson 1999). Young's analysis of domination and oppression similarly makes relations of power and participation constitutive objects of justice rather than secondary effects of an independently assessed distribution (Young 1990). Honneth's recognition theory, although grounded in a different philosophical project, further indicates that institutionalized relations of disrespect can be normatively significant even where an allocative measure alone does not register the injury (Honneth 1995).

Procedural and relational justice should nevertheless remain distinct. A procedure can be participatory while the surrounding social relation remains coercive; a relationship can exhibit mutual respect while the governing procedure lacks transparency or review; and a formally neutral procedure can reproduce inequalities generated outside the immediate decision setting. Theories of justice therefore differ over which background conditions count, which inequalities undermine standing, and which forms of justification are required.

This distinction will later matter for GR because relational systems can be evaluated at more than one level. One may ask whether an outcome is just, whether the procedure that generated it is just, whether the relations among participants are just, and whether the background process through which those relations and procedures became available was itself just. Chapter 2 should not yet turn that observation into a new GR taxonomy of justice. Existing procedural, relational, recognition-based, and structural theories already establish the intellectual possibility of evaluating more than final distributions. The later task is to determine how those dimensions interact when relations and rules themselves evolve over time.

#### 2.15.4 Norm Formation and Nomos

Normative orders persist through more than philosophical principles. They are reproduced through expectations, habits, sanctions, legal rules, institutional practices, interpretations, narratives, and shared understandings of what counts as valid, appropriate, obligatory, or deviant. The formation of norms therefore belongs simultaneously to moral psychology, sociology, institutional analysis, jurisprudence, and political theory. The concept of *nomos* adds a further dimension by directing attention toward the broader normative world within which prescriptions acquire meaning.

Bicchieri's theory of social norms analyzes compliance through empirical and normative expectations rather than treating every regularity as a norm (Bicchieri 2006). Individuals may follow a norm because they expect relevant others to conform and because they believe others expect conformity from them. This makes norm for-



mation dependent upon beliefs, reference networks, conditional preferences, and changing information. The theory is particularly useful because it separates norm-governed conduct from generic habit, convention, or private moral commitment.

Legal theory supplies a different account of normative order. Hart's analysis of primary and secondary rules explains legal systems through practices that distinguish obligations from rules for recognizing, changing, and adjudicating other rules (Hart 2012). The rule of recognition is especially important because legal validity depends upon a social practice among officials rather than upon each legal proposition being derived from a separate moral judgment. Hart thereby distinguishes legal normativity from morality without denying that law operates through social practices of acceptance.

Ostrom's institutional analysis shows that operational rules can also emerge and persist through self-organized arrangements rather than only through centralized legislation (Ostrom 1990; Ostrom 2005). Rules-in-use structure positions, choices, information, payoffs, and collective action in specific action arenas. This broadens the study of normative order beyond formal statutes and courts. Communities can generate durable institutional arrangements through repeated interaction, monitoring, graduated sanctions, boundary rules, and procedures for changing rules themselves.

Cover's concept of *nomos* addresses another layer of the problem. In *Nomos and Narrative*, law is located within a normative universe composed not only of formal prescriptions and institutions but also of narratives through which communities understand what is lawful, unlawful, valid, obligatory, and possible (Cover 1983). Normative meaning is therefore connected to histories, commitments, interpretive communities, and imagined futures. Legal texts do not exhaust the normative worlds in which they operate, and multiple communities can generate competing normative meanings around the same formal legal material.

The term *nomos* should not therefore be treated as a synonym for either a single norm or positive law. A norm can be one rule or expectation within a wider order; a legal rule can acquire institutional validity through recognized procedures; a social norm can be sustained through reciprocal expectations; a *nomos*, in Cover's sense, names a broader normative universe in which rules and practices are situated within narratives of origin, authority, identity, and aspiration. These levels can align, but they can also diverge. Formal law may prohibit a practice that remains socially normalized; a community may generate a normative commitment not yet recognized by state law; institutional practice may reinterpret a legal rule; and competing narratives can make the same prescription intelligible in incompatible ways.

This plurality gives norm formation a temporal character. Norms can stabilize through repetition, social expectation, enforcement, institutionalization, narrative legitimation, and embodied habit. They can also weaken when expectations change, authorities lose legitimacy, interpretive communities split, or new experiences render established prescriptions untenable. Later GR can draw upon these traditions when analyzing how normative relations are generated and maintained. The genealogical point remains prior: sociology, jurisprudence, institutional analysis, and legal theory already provide multiple mechanisms through which normative orders become socially real.

### 2.15.5 Revisability of Normative Orders

A normative order that can guide conduct must possess some stability, yet a normative order that cannot be criticized or revised risks converting historical arrangements into unquestionable authority. Modern moral, legal, and political theory therefore repeatedly confronts a tension between continuity and revisability. Theories differ over who may challenge a norm, what reasons count as valid criticism, which procedures authorize change, and whether revision concerns the application of an existing norm or the norm itself.

Dewey's pragmatism supplies one model of revisability. Valuations, ends, and institutional arrangements can become objects of inquiry when their consequences generate conflict or frustration (Dewey 1939). Revision does not require abandoning normative judgment; it requires treating established standards as fallible and responsive to experience. The process is reconstructive because inquiry can alter both the proposed solution and the criteria through which the problem is understood.

Habermas develops a different model in which the legitimacy of law and democratic institutions is connected to processes of public justification and deliberation (Habermas 1996). The relation between facticity and validity means that legal norms operate as socially effective institutions while also making claims to legitimacy that can be criticized. Democratic procedures are therefore important not only because they aggregate preferences but because they organize conditions under which norms can be publicly contested, justified, and revised. Habermas's account remains much more procedurally and discourse-theoretically specified than Dewey's pragmatist reconstruction.

Sen and Young provide additional reasons why normative revision may be required even without agreement on a complete ideal theory. Sen's capability-oriented approach emphasizes comparative assessment of actual freedoms and remediable injustice (Sen 1999). Young's work demonstrates that norms and institutions presented as impartial can reproduce exclusion when the standpoint embodied in them is socially particular (Young 1990). Revision can therefore concern the informational basis of judgment, the composition of decision-making publics, the institutional distribution of voice, and the categories through which injustice becomes perceptible.

Cover's nomos adds a further complication. Normative change need not originate only within centralized lawmaking institutions. Interpretive communities can generate alternative normative meanings and narratives that challenge official legality or reorient its future development (Cover 1983). Such plurality can be generative, but it can also produce conflict among normative worlds. The existence of competing nomoi does not itself determine which claim is just. It shows that normative order is historically inhabited and that legal meaning can develop through struggles over interpretation, memory, authority, and imagined futures.

The possibility of normative revision also creates a second-order problem. If norms guide the evaluation of conduct, what guides the evaluation of the norms themselves? Different traditions provide different answers: practical wisdom, universalizability, mutual justification, democratic deliberation, public reason, capability expansion, opposition to domination, or responsiveness to consequences. No single criterion can be imported into GRE as an uncontested foundation. A theory

of normative change must therefore distinguish the historical explanation of how a norm changes from the normative justification of whether that change is desirable. Genealogy alone cannot establish validity, just as abstract validity alone does not explain how normative orders become socially effective.

The lineages reconstructed in this section provide a limited foundation for later GR and GRE. Existing ethical theory distinguishes character, duty, reasons, mutual justification, and practical inquiry. Theories of justice broaden evaluation from allocation to capabilities, rights, institutions, domination, recognition, procedure, and relations among persons. Sociology and jurisprudence explain how norms become socially and legally stabilized. Cover's *nomos* places legal prescription within wider normative worlds of narrative and communal meaning. Pragmatist and discourse-theoretic traditions make normative orders criticizable and revisable rather than historically frozen.

Later GR can build upon this inheritance by examining how normative judgments, procedures, relations, institutions, and interpretive worlds become coupled across time; how the conditions under which a norm is formed differ from the conditions under which it is later justified; and how changing relations can alter the very criteria through which subsequent relations are judged. That later programme should preserve a decisive distinction established by the prior literature: the *emergence* of a norm, its *social effectiveness*, its *legal validity*, and its *normative justification* are different questions. Keeping them distinct allows GR to study the generation and transformation of normative orders without reducing justice to historical success, institutional stability, or mere social acceptance.

## 2.16 Classical Political Economy and Social Wealth

The preceding sections established philosophical and social-theoretical foundations for value, normativity, subject formation, institutional reality, and historically structured social change. Classical political economy provides the first sustained economic lineage in this chapter in which these concerns are assembled around the production, circulation, distribution, and reproduction of social wealth. The objective of the present section is to reconstruct how major classical writers conceptualized wealth and production, labor and specialization, exchange and markets, distribution among social classes, and the relation between economic order and wider social structure. The discussion proceeds from early political economy and physiocratic reproduction through Smith, Ricardo, Malthus, and Mill, with Marx appearing only as a later critical continuation that will receive separate treatment. The method is genealogical and comparative. Classical political economy is treated as a heterogeneous field rather than a unified doctrine, and later GRE questions are introduced only at the level of intellectual inheritance.

### 2.16.1 Wealth and Production

Classical political economy emerged before economics was organized primarily around the allocation of scarce means among alternative ends. Its central objects included the sources of national wealth, the organization of productive activity, the

reproduction of material conditions across time, the relation among agriculture, manufacture, and commerce, and the institutional arrangements under which an economic order could persist or expand. The category of *wealth* therefore had a social and historical breadth that should not be identified automatically with later concepts of utility, welfare, gross domestic product, or monetized asset value.

James Steuart's *Inquiry into the Principles of Political Oeconomy* illustrates the breadth of this earlier problem-space. Political economy appears there as a science of domestic policy encompassing population, agriculture, industry, trade, money, circulation, public credit, taxation, and the distribution of inhabitants among different classes of employment (Steuart 1767). The economic order is consequently inseparable from questions of population, government, occupational differentiation, and monetary circulation. Steuart's framework does not provide the later Smithian system, but it shows that political economy originally addressed the organization of a society rather than an autonomous market sphere abstracted from political and social relations.

Physiocracy supplied a different early architecture. Quesnay's *Tableau économique*, developed in 1758–1759 and preserved in later critical editions, represented the annual circulation of expenditures and revenues among a productive agricultural class, proprietors, and what physiocratic terminology called the “sterile” class (Quesnay 1972). Its substantive privilege accorded to agriculture is historically specific and was rejected by later political economy. Its analytical importance lies elsewhere: wealth appears as a reproduced social flow requiring advances, expenditure, circulation, class relations, and the renewal of conditions that permit another annual cycle. Production is therefore already connected to reproduction and distribution rather than treated as an isolated technical act.

Smith's *Wealth of Nations* reorganized the problem. The wealth of a society is connected to the annual produce of its land and labor, while the productive powers of labor depend importantly on division of labor, accumulation of stock, and the organization of exchange (Smith 1776). Smith's analysis moves repeatedly between individual activities and aggregate social consequences. Productive capacity is affected by specialization; specialization is limited by the extent of the market; accumulation supports the employment of labor; and the annual produce is distributed through wages, profit, and rent. Wealth is thus neither a mere stock of precious metal nor an attribute of isolated persons. It is a property of a socially organized process of production and circulation.

The classical category of productive labor also reveals historically specific judgments about what counts as wealth creation. Smith connected productive labor to labor that adds value to a vendible commodity and contributes to accumulation, while later writers disputed the boundary between productive and unproductive activity (Smith 1776; Malthus 1820; Mill 1848). Malthus defended a conception of wealth that emphasized accumulation and material objects capable of entering national stock, whereas Mill retained a productive/unproductive distinction while modifying its formulation and embedding it in a wider treatment of utilities, capital, and productive consumption (Malthus 1820; Mill 1848). These classifications should be read historically. They encode assumptions about durable wealth, services, accumulation, and the economic significance of different forms of labor rather than supplying a timeless

ontology of productive contribution.

Malthus also complicated any simple identification between saving, accumulation, and increasing wealth. His *Principles of Political Economy* examines accumulation as one possible stimulus to growth while insisting that continued expansion depends on conditions of demand, distribution, consumption, and profitable employment as well as on the capacity to save (Malthus 1820). This disagreement with Ricardian tendencies is important because it shows that classical political economy already contained competing accounts of how production is sustained. The supply of productive capacity and the realization of output through effective demand could not simply be assumed to coincide.

Mill's *Principles of Political Economy* provides a late-classical synthesis in which production, distribution, exchange, and social philosophy are explicitly joined (Mill 1848). Mill distinguishes conditions of production that follow from material and technological constraints from rules of distribution that depend substantially on social institutions, laws, and customs. Whatever one makes of the sharpness of this distinction, it makes a foundational point visible: the quantity and form of social wealth cannot be understood solely through physical production. Property, institutional arrangements, and distribution shape who controls wealth, how it is used, and which forms of economic order are reproduced.

The classical lineage therefore leaves several different meanings of production in view. Production can refer to transformation of material conditions, mobilization of labor and capital, reproduction of annual advances, generation of a surplus, or expansion of a society's capacity to sustain future activity. These meanings overlap without being equivalent. Later GRE can inherit this breadth while remaining free to reconsider classical exclusions concerning care, services, knowledge, ecology, and other forms of contribution. Chapter 2 requires only the narrower historical conclusion: classical political economy made social wealth and its reproduction central economic objects long before economics was reorganized around marginal allocation.

### 2.16.2 Labor and Division of Labor

Labor occupies a distinctive place in classical political economy because it connects material production to social organization. The classical writers did not treat labor only as a quantity of effort. They investigated the organization of work, specialization, skill, cooperation, wages, productive capacity, and the relation between workers and owners of property. The division of labor therefore belongs simultaneously to theories of production and to theories of social differentiation.

Smith gives the canonical account. Division of labor increases productive powers through specialization, improved dexterity, saving of time, and the possibility of machinery adapted to specialized tasks (Smith 1776). Yet the mechanism is social rather than purely technical. Specialization presupposes exchange and is limited by the extent of the market. A more extensive network of exchange can support finer differentiation of occupations; greater differentiation can in turn increase output and deepen interdependence among producers. The famous manufacture examples therefore sit within a broader account of social coordination.

This account contains a tension that becomes important for later political econ-

omy. The same specialization that raises productivity can narrow the range of activities performed by individual workers and alter the distribution of knowledge, skill, and dependence within society. Smith's broader work recognizes educational and civic problems associated with extreme occupational specialization even though the productivity analysis in Book I emphasizes its material advantages (Smith 1776). Division of labor is therefore already more than a production technique. It reorganizes capacities and relations among persons.

Ricardo treats labor within a more abstract analytical system concerned with value, wages, profit, rent, and accumulation (Ricardo 1817). His labor-centered analysis of value applies under specified conditions and is complicated by capital durability, time, machinery, and differing production structures. The importance for the present genealogy lies less in identifying a single classical labor theory of value than in recognizing how labor became a common term connecting production conditions to distributive conflict. Changes in wages could affect profits; technical change could alter demand for labor; and class income depended on the structure through which the social product was divided.

Mill retains labor as an agent of production while emphasizing the joint importance of capital, natural conditions, knowledge, cooperation, and combined labor (Mill 1848). His treatment helps separate two questions that later economic theory often distinguishes more sharply: what makes coordinated production technically effective, and what institutional relations determine claims over the resulting product. Combined labor can increase productive capacity, while ownership and distributive rules determine how the advantages of cooperation are apportioned.

The classical treatment of division of labor consequently provides an important intellectual foundation for relational economic analysis without already constituting such an analysis. Specialization creates dependence among differentiated activities; market extension changes the feasible degree of specialization; the organization of work alters productive capacities; and ownership structures mediate claims upon the product. These are relational observations in an ordinary analytical sense. They do not establish the stronger GR proposition that subjects and relations are recursively generated through changing relational systems. They instead make that later question historically intelligible.

A further distinction is necessary. Productive contribution, productive necessity, and distributive entitlement are separate problems. Classical political economy frequently connected them through prevailing property and class arrangements, but the connection was contested even within the tradition. Labor may be necessary to a production process without the laborer controlling the product; ownership may create a legally recognized claim without directly corresponding to labor performed; organizational or technological change may alter the necessity of a particular task while leaving social status or income relations partly intact. Later GRE will return to these separations under conditions of automation and capability asymmetry. Section 45 records their classical prehistory rather than supplying a contemporary resolution.



### 2.16.3 Exchange and Markets

Exchange is central to classical political economy, but the market in this literature should not be treated as a single self-contained mechanism. Smith, Ricardo, Malthus, and Mill analyze exchange through different combinations of specialization, money, price, demand, production cost, trade, and institutional arrangement. Markets coordinate activities, transmit claims on output, and affect the scale of specialization, while remaining embedded in wider structures of property and production.

Smith links exchange to the division of labor and to the emergence of money as a practical medium that facilitates increasingly differentiated production (Smith 1776). His distinction between natural and market prices provides a way of analyzing temporary deviations as well as longer-run conditions associated with wages, profit, and rent. Competition matters within this account, but exchange is not analytically prior to production and distribution. The organization of price presupposes property, production, differentiated income claims, and an existing social division of labor.

Ricardo further systematizes the relations among value, natural and market prices, rent, wages, profit, taxation, trade, and accumulation (Ricardo 1817). Foreign trade becomes an important part of the analysis because differences in relative production conditions can make exchange mutually advantageous even when one country possesses absolute productivity advantages across activities. At the same time, Ricardo's framework remains strongly concerned with how the gains and burdens associated with economic change are distributed among classes. Market exchange does not dissolve the distributive problem; it operates within it.

Malthus introduces a significant disagreement over demand and the conditions under which production is actually sustained. His treatment of demand and supply distinguishes the existence of productive capacity from an effectual demand sufficient to maintain continued supply, while his analysis of accumulation questions whether increased saving and productive employment automatically guarantee a continued increase of wealth (Malthus 1820). The disagreement is theoretically important even where later economics reformulates its terms. Classical political economy therefore contained a live dispute over whether production generates adequate demand through its own operation or whether the composition of expenditure and distribution can obstruct realization and continued accumulation.

Mill offers another useful distinction. In his treatment of production and distribution, exchange functions as machinery through which the social product is apportioned under a commercial system rather than as the fundamental source of all distributive relations (Mill 1848). Property institutions and class positions are analytically prior to some of the claims that are subsequently expressed through market prices and monetary exchange. This prevents a direct identification of observed market outcomes with an institution-free distribution generated by exchange alone.

Classical market analysis therefore leaves at least four separable objects: the social differentiation that creates reasons for exchange; the monetary and price mechanisms through which exchange occurs; the production and demand conditions that sustain transactions; and the property and class structures that determine participants' positions before and after exchange. Later theories may reorganize these objects, and marginalist economics will place different analytical weight on utility,

scarcity, substitution, and equilibrium. The classical lineage is important precisely because it preserves a broader conception of markets as parts of a social process of production and distribution.

For later GRE, this creates a useful foundation for distinguishing exchange from conversion. Exchange normally concerns transfers under some recognized equivalence, price, contract, or reciprocal arrangement. A broader theory of value conversion may also need to examine transformations among heterogeneous forms of value for which no complete common metric exists. That stronger claim belongs later in the book. The classical tradition supplies the narrower precedent that economic circulation changes the form, location, and social command of wealth without being reducible to the physical act of production.

#### 2.16.4 Distribution and Social Classes

Distribution is one of the defining objects of classical political economy. The question concerns more than inequality among individuals. Classical writers commonly analyze how the social product is divided among structurally differentiated groups whose claims arise from labor, ownership of stock or capital, and ownership of land. Wages, profits, and rent are therefore simultaneously income categories and expressions of a particular organization of production and property.

Smith's analysis of the component parts of price and the rates of wages, profit, and rent establishes an influential class structure within political economy (Smith 1776). Workers, owners of stock, and landlords occupy different positions in relation to production and receive different forms of income. Smith also attends to differences in bargaining position and to the ways in which legal and institutional circumstances affect labor and property. The distribution of the annual product is therefore connected to social relations among groups rather than appearing as a purely technical decomposition of output.

Ricardo places distribution even more explicitly at the center of political economy. His preface organizes the problem around three classes—landowners, owners of capital, and laborers—and the changing proportions of the social product received as rent, profit, and wages (Ricardo 1817). Accumulation, population, agricultural conditions, technology, and the cultivation of land affect these shares. Ricardo's theory of rent and his analysis of wages and profits consequently treat class distribution as a dynamic problem linked to economic development rather than as a fixed accounting identity.

Malthus shares many of these categories while disputing important Ricardian conclusions. His treatment of rent, profits, wages, accumulation, and effective demand gives landlords, capitalists, laborers, consumers, and unproductive expenditure different roles in the maintenance of demand and wealth (Malthus 1820). The disagreement matters because it shows that a common class vocabulary did not yield a common theory of the relation between distribution and growth. A distributive arrangement could affect demand, accumulation, and the realized expansion of wealth differently under competing classical accounts.

Mill makes the institutional status of distribution unusually explicit. He argues that the rules through which wealth is distributed depend on laws and customs and

can vary across societies even though any chosen arrangement has consequences that must be understood empirically (Mill 1848). Property is therefore not a neutral background fact. It helps constitute the classes and claims through which distribution occurs. Mill's discussion of landowners, capitalists, and laborers preserves classical categories while opening the possibility that their relations can be reorganized through institutional change.

The classical distribution problem should therefore be distinguished from a purely statistical distribution of income. It concerns positions within the organization of production, legally and socially recognized claims, class-specific income forms, and the consequences of accumulation for those positions. A society can display a particular distribution of monetary income for many reasons; classical political economy asks how some of those reasons are rooted in land, capital, labor, property, and the organization of the productive process.

Marx's later critique transforms this inherited problem by reconstructing capital, wage labor, surplus value, accumulation, and class relation within a theory of capitalist production (Marx 1867). The conceptual transition is important, but its detailed treatment belongs to the later sections devoted to Marxism, historical materialism, circulation, and reproduction. For the present genealogy, Marx demonstrates that classical categories of labor, property, surplus, and class could become objects of immanent critique rather than merely elements of an accepted economic order.

This classical focus gives later GRE a valuable inheritance: distribution can be analyzed as a relational problem concerning how claims to socially produced value are constituted and maintained. Yet classical class categories should not be universalized. Modern economies include corporate forms, financial claims, public institutions, platforms, intellectual property, care work, ecological dependencies, data infrastructures, and heterogeneous forms of capital that require additional analysis. The classical framework supplies a historical foundation for asking who participates in production, who controls productive conditions, and through what relations the resulting value is appropriated and distributed.

### 2.16.5 Economic Order and Social Structure

Classical political economy ultimately treated economic life as part of a wider social order. Production depended on legal property arrangements, accumulated stock, population, knowledge, infrastructure, division of labor, and political conditions. Exchange presupposed monetary and institutional arrangements. Distribution reflected durable social positions. Accumulation altered the relative importance and interests of classes across time. Political economy therefore remained connected to history, governance, and social structure even when individual authors disagreed sharply about the appropriate role of public authority or the mechanisms of economic coordination.

Steuart's formulation of political economy as domestic policy makes this connection especially visible (Steuart 1767). Population, employment, agriculture, commerce, money, credit, and taxation belong to one problem of governing and sustaining an economic society. Quesnay's physiocratic system similarly links the reproduction of wealth to an ordered circulation among classes and to conditions

affecting agricultural advances and annual reproduction (Quesnay 1972). Their substantive conclusions differ, but both precede a clean separation between “the economy” and the institutional order in which economic reproduction occurs.

Smith’s account likewise extends well beyond exchange. Different historical arrangements of land, towns, commerce, public revenue, defense, education, and colonial policy affect the development of opulence and the organization of productive activity (Smith 1776). The famous defense of market exchange therefore forms part of a broader political economy concerned with institutional history and public functions. Treating Smith only as a theorist of decentralized exchange would obscure the range of social and governmental conditions examined in the work.

Ricardo narrows some dimensions of the inquiry while making distributional structure analytically sharper. Economic development changes rents, profits, wages, and the interests attached to land, capital, and labor; taxation and trade policy redistribute burdens across these positions; technical change can alter the demand for labor (Ricardo 1817). The social order is consequently dynamic even where Ricardo’s formal abstractions are more pronounced than Smith’s historical narrative.

Mill makes the connection to social structure explicit through the subtitle of his work and through his treatment of property, institutions, progress, and distribution (Mill 1848). Production operates under material conditions, while institutional arrangements shape property and the distribution of wealth. Economic analysis therefore interacts with questions of social philosophy without collapsing into them. This distinction is useful for GRE because it permits economic inquiry to remain a domain-specific project while recognizing that the conditions under which economies operate are partly legal, political, cultural, and historical.

Several inheritances from classical political economy are therefore important for the later development of GRE. First, wealth can be treated as a socially organized and temporally reproduced phenomenon rather than only as an individual possession. Second, production depends on differentiated activities whose coordination changes productive capacity. Third, exchange takes place within prior structures of production, property, and distribution. Fourth, class and distributive positions can alter the trajectory of accumulation and the reproduction of the economic order. Fifth, economic institutions are historically variable even when their consequences are subject to material constraints.

These inheritances do not establish a generative-relational economics. Classical political economy generally works with categories—labor, capital or stock, land, rent, profit, wages, productive and unproductive activity, social classes—whose boundaries and ontological status vary across authors and historical contexts. GRE will eventually ask how such categories, relations, capacities, and forms of value are themselves generated, stabilized, converted, contested, and transformed. That later move requires additional foundations from marginalism, Marxism, institutional economics, economic sociology, relational theory, evolutionary thought, ecology, complexity, and formal sciences. Section 45 supplies one indispensable lineage: economic order as the historically structured production, circulation, distribution, and reproduction of social wealth.

## 2.17 Marginalism, Neoclassical Economics, and Allocation

Classical political economy organized economic inquiry around social wealth, production, accumulation, exchange, and distribution among structurally differentiated classes. Marginalism and the later neoclassical tradition did not simply discard these objects, but they changed the analytical center of gravity. Value was increasingly reconstructed through marginal evaluation, economic action through constrained choice, coordination through prices and equilibrium, and welfare through properties of alternative allocations. The objective of this section is to reconstruct that transformation without treating “marginalism” or “neoclassical economics” as a single internally homogeneous doctrine. The discussion proceeds from marginal theories of value and utility through scarcity and choice, equilibrium and coordination, welfare and allocation, and finally information, incentives, and allocation mechanisms. Its method remains genealogical. The analytical gains of abstraction are identified together with the assumptions under which they operate, while stronger GR and GRE claims about the generation of preferences, agents, relations, values, and feasible sets are reserved for later chapters.

The terminology itself requires restraint. Jevons, Menger, and Walras are commonly grouped within the marginal revolution, yet their accounts of utility, value, exchange, and economic method differ substantially. Marshall’s partial-equilibrium synthesis is not identical with Walrasian general equilibrium; Pareto’s ordinal reformulation changes the status of utility; Robbins’s scarcity definition changes the disciplinary object of economics; Hicks and Samuelson further reorganize consumer theory and formal method; Arrow and Debreu provide a rigorous existence framework under explicit assumptions. “Neoclassical economics” is therefore used here as a broad historical family of approaches in which marginal reasoning, constrained optimization, price-mediated coordination, and equilibrium analysis became especially influential. It is not treated as a timeless or perfectly unified theoretical system.

### 2.17.1 Marginal Value and Utility

The marginalist reorganization of value shifted attention from the labor, cost, or class-distribution problems that dominated much classical political economy toward the relation between available quantities, wants, and incremental evaluation. This shift did not yield a single theory. Jevons, Menger, and Walras developed different conceptual and methodological architectures, but each made the value of an additional unit relative to circumstances of use and availability analytically central.

Jevons’s *Theory of Political Economy* explicitly reconstructs value through utility and the “final degree of utility,” connecting exchange ratios to marginal evaluations rather than to embodied labor alone (Jevons 1871). Utility in this framework varies with quantity: an additional increment of a good generally contributes differently depending on how much of the good is already available. This makes the margin analytically decisive. The object of explanation becomes less the historical origin of an entire social product and more the conditions under which incremental units are valued and exchanged by choosing agents.

Menger’s *Grundsätze der Volkswirtschaftslehre*, also published in 1871, arrives at



marginal valuation through a different route (Menger 1871). Goods acquire economic character in relation to human needs and the quantities available for satisfying them. Value is connected to the importance of satisfactions that depend on command over particular quantities of goods. The conceptual emphasis is therefore subjective without being reducible to a numerical psychology. Menger's account of goods of different orders, exchange, price, and money also develops causal sequences that differ from Jevons's more explicitly mathematical treatment.

Walras's *Éléments d'économie politique pure* connects marginal evaluation to a much more systematic theory of mutually interdependent markets (Walras 1874). His concept of *rareté* links utility and limited quantity, while exchange under free competition is represented through systems of demand, offer, prices, and equilibrium conditions. The marginal problem thus becomes inseparable from simultaneous market interdependence. Whereas Menger emphasizes causal formation from individual economizing and Jevons focuses on utility and exchange at the margin, Walras develops a mathematical architecture in which many markets must be solved together.

Marshall's *Principles of Economics* later integrates marginal demand analysis with supply, cost, production, time, and industrial organization (Marshall 1890). Marshall's famous use of the two blades of scissors resists a one-sided theory of value: market value is shaped jointly by conditions of demand and supply, with the relative analytical importance of each varying across time horizons. His partial-equilibrium method isolates a market or problem under simplifying conditions rather than solving an economy-wide system simultaneously. This methodological difference from Walras is as important as their common use of marginal reasoning.

Pareto further changes the status of utility. In the *Manual of Political Economy*, preference orderings and indifference analysis permit economic choice to be represented without requiring a measurable cardinal quantity of pleasure (Pareto 1971). Hicks develops this ordinal reformulation more systematically in *Value and Capital*, replacing much older marginal-utility language with indifference curves, marginal rates of substitution, income and substitution effects, and a theory of consumer demand based on preference orderings rather than interpersonal or cardinal measurements of satisfaction (Hicks 1939b).

The resulting lineage should therefore be described carefully. Marginalism does not merely replace "objective" value with "subjective" value. It relocates a major part of economic analysis toward incremental trade-offs, ordering of alternatives, and the behavior of agents facing limited quantities and competing uses. The gain is substantial: local choice, substitution, demand response, and relative valuation become tractable in a way that supports precise comparative reasoning. The abstraction also postpones other questions. Preferences, wants, and the identity of goods are often treated as sufficiently given for the purpose of the model, even though other traditions ask how they are socially formed, historically transformed, or institutionally mediated. Chapter 2 need not resolve that tension. It is enough to identify it as one boundary between marginal analysis and the later generative questions of GRE.



### 2.17.2 Scarcity and Choice

Marginal analysis becomes especially influential when joined to a conception of economics centered on scarcity and choice. Scarcity in this lineage does not mean absolute material shortage alone. It concerns the relation between limited means, multiple possible uses, and ends that cannot all be simultaneously realized. This formulation permits the economic problem to be represented across a wide range of domains, but it also changes what counts as the characteristic object of economics.

Robbins's *Essay on the Nature and Significance of Economic Science* gives the canonical formulation: economics studies human behavior as a relation between ends and scarce means that have alternative uses (Robbins 1932). The importance of the formulation lies partly in its abstraction from the substantive content of ends. Economics can analyze choice among alternatives without determining whether the ends themselves are morally good, culturally specific, or historically generated. Scarcity is therefore formal and relational: a means is scarce because it is insufficient relative to competing uses, not simply because its physical quantity is small.

This formulation consolidates tendencies already present in marginalism. If agents rank alternatives, if resources can be directed toward different uses, and if opportunity cost accompanies selection, then economic analysis can focus on feasible sets and choices within them. The resulting framework is powerful because it permits common analytical tools to be applied to consumption, production, labor supply, intertemporal choice, portfolio allocation, and many other problems. Samuelson's *Foundations of Economic Analysis* further formalizes maximizing behavior and equilibrium systems within a common mathematical vocabulary (Samuelson 1947). The diversity of substantive settings can then be represented through structurally similar constrained problems.

The abstraction does not imply that every neoclassical model assumes literal psychological calculation by fully informed individuals. Optimization can function as a representation of choice consistency, a characterization of equilibrium behavior, or an analytical device under specified conditions. Likewise, the feasible set need not be interpreted as technologically fixed in every application. Yet much of the analytical convenience arises from treating ends, constraints, available alternatives, and agent boundaries as sufficiently specified at the point of analysis.

This is a decisive shift from much classical political economy. The central question is no longer only how a social surplus is produced and distributed among classes, but how limited resources are allocated among alternative uses given preferences, technologies, and endowments. Distribution remains present, but it can enter as an initial endowment, a budget constraint, a property-right structure, or an outcome of market exchange rather than always as the primary organizing problem. The economic subject correspondingly appears more often as a chooser, consumer, producer, or owner of resources whose relevant characteristics are represented through preferences, technologies, and constraints.

The distinction between scarcity and deprivation is important. A society can face scarcity in the formal Robbinsian sense even when material abundance is high, because resources such as time, attention, land, computational capacity, skilled labor, or ecological absorption remain limited relative to possible uses. Conversely, severe

deprivation cannot be understood solely by noting that scarce resources must be allocated. Sen's later entitlement and capability approaches, treated elsewhere in this chapter, show why command over resources and substantive possibilities may differ even where aggregate availability is unchanged. The scarcity-choice framework identifies a real structural problem, but it does not by itself determine which ends matter, how entitlements arise, or whether the initial distribution is just.

For later GRE, this lineage establishes a foundation that should be retained rather than rejected. Trade-offs, opportunity costs, constraints, and alternative uses remain economically indispensable. The later generative question is different: how are the ends, resources, constraints, capabilities, and recognized alternatives themselves produced and transformed? That question supplements rather than invalidates the scarcity-choice problem.

### 2.17.3 Equilibrium and Coordination

If marginalism gives a theory of incremental choice, equilibrium analysis provides a theory of mutual consistency among choices and constraints. Equilibrium has several meanings across economics, and it should not be identified automatically with historical stasis or social harmony. At minimum, an equilibrium representation specifies a configuration in which a set of modeled conditions are simultaneously satisfied. The interpretation of those conditions differs across partial equilibrium, general equilibrium, temporary equilibrium, and later strategic or dynamic models.

Walras provides the foundational general-equilibrium architecture. Prices connect demand and supply across multiple markets, and equilibrium requires simultaneous compatibility among the decisions represented in the system (Walras 1874). The analytical achievement is not simply a claim that markets “balance themselves.” It is the representation of interdependence: a change in one price, endowment, technology, or demand condition can propagate through other markets because the equations are jointly connected. The economy becomes representable as a coordinated system of exchange and production rather than a collection of isolated bilateral trades.

Marshall develops a different strategy. Partial equilibrium deliberately holds many surrounding conditions comparatively fixed in order to study one market or adjustment problem with greater local clarity (Marshall 1890). The method sacrifices economy-wide simultaneity in exchange for analytical tractability and attention to time, industry-specific conditions, and supply responses. The contrast with Walras therefore concerns method as much as doctrine: one approach emphasizes system-wide consistency, while the other isolates a tractable domain under controlled abstraction.

Pareto and Hicks further transform equilibrium analysis. Pareto links general equilibrium to ordinal preferences and the analysis of efficient allocations; Hicks develops an integrated theory of value, substitution, expectations, and temporary equilibrium that makes explicit how current decisions can depend on anticipated future conditions (Pareto 1971; Hicks 1939b). Samuelson then systematizes equilibrium conditions and comparative statics within a general mathematical program (Samuelson 1947). Comparative statics asks how an equilibrium configuration changes when parameters change. It is therefore a theory of differences between modeled equilibria

rather than, by itself, a theory of the historical path through which one configuration becomes another.

Arrow and Debreu provide a major formal consolidation. Their 1954 paper proves existence results for competitive equilibrium in an integrated model of production, exchange, and consumption under explicit assumptions (Arrow and Debreu 1954). Debreu's *Theory of Value* later presents an axiomatic framework organized around commodities and prices, producers, consumers, equilibrium, optimum, and uncertainty (Debreu 1959). These works clarify what must be assumed for a competitive-equilibrium solution to exist. Existence is a mathematical property of a formal system; it should not be confused with a claim that every actual economy rapidly converges to such an equilibrium, that the equilibrium is unique, or that the institutional process of reaching it is costless.

Coordination is therefore analytically separable from equilibrium. A price system can be studied as one institution through which dispersed plans are made mutually compatible, but institutional coordination can also occur through firms, contracts, associations, public administration, customary rules, or other mechanisms. Coase's theory of the firm makes this explicit by asking why transactions are sometimes coordinated within organizations rather than through repeated market exchange (Coase 1937). Hayek adds another dimension: the relevant knowledge for coordination is dispersed, incomplete, and often local, so an economic order must be assessed partly by how it communicates and uses information distributed among many actors (Hayek 1945).

The equilibrium tradition therefore contributes several distinct analytical resources: mutual consistency, system-wide interdependence, local comparative analysis, price-mediated coordination, and formal conditions for existence and optimality. None requires the stronger claim that an economy is fundamentally an equilibrium object. For later GRE, equilibrium can remain one useful representation of a stabilized configuration, while trajectories, institutional change, changing preferences, transformed capacities, and endogenous modification of the feasible set require additional tools.

#### 2.17.4 Welfare and Resource Allocation

Once economic analysis is organized around choice and equilibrium, a normative question follows: how should alternative allocations be evaluated? Welfare economics develops several answers, and their differences are important. Efficiency, aggregate welfare, compensation tests, distribution, and social evaluation should not be treated as interchangeable concepts.

Pareto supplies the best-known efficiency criterion. An allocation is Pareto-improvable if at least one person can be made better off without making anyone worse off; a Pareto-efficient allocation admits no such improvement. The importance of the criterion is its limited informational demand: it can identify some unambiguous improvements without requiring a complete cardinal comparison of welfare across persons. Its limitation follows from the same restraint. Many radically different distributions can be Pareto efficient, and the criterion alone does not determine which among them is just or socially preferable. Pareto efficiency is therefore a prop-

erty of an allocation relative to preferences and feasibility, not a complete theory of welfare or justice (Pareto 1971).

Pigou's *Economics of Welfare* develops a broader welfare-economic project centered on economic welfare and the national dividend, while giving special analytical importance to divergences between private and social net product (Pigou 1920). External effects create a reason why individually advantageous decisions may fail to produce socially desirable outcomes. This line of analysis makes the institutional environment of allocation relevant: taxes, subsidies, public provision, regulation, or other arrangements may alter the relation between private incentives and social consequences.

The “new welfare economics” of the late 1930s sought to formulate welfare propositions while reducing reliance on interpersonal cardinal utility comparisons. Hicks and Kaldor developed compensation-based criteria under which a change could count as a potential improvement when beneficiaries could in principle compensate those who lose (Hicks 1939a; Kaldor 1939). These criteria expanded the domain of welfare comparison beyond strict Pareto improvements, but they also generated controversies concerning actual compensation, distribution, reversals, and the normative significance of willingness and ability to pay. They therefore illustrate a recurring problem: a more operational comparison rule can gain analytical reach while embedding assumptions about what information and claims are allowed to count.

General-equilibrium welfare theory later establishes deep connections between competitive allocation and Pareto efficiency under specified conditions. The significance of these results lies in identifying the assumptions under which decentralized price-mediated choice has strong efficiency properties. Those assumptions concern preferences, technologies, market completeness, information, and other structural conditions; when they fail, the conclusions cannot simply be carried over unchanged. Debreu's axiomatic organization of equilibrium and optimum makes the conditional character of the analysis especially clear (Debreu 1959).

Resource allocation in this tradition is therefore a precisely structured problem. There are agents or units, resources or commodities, feasible transformations and exchanges, preferences or objectives, and institutional rules through which an allocation is selected. The framework can answer important questions about efficiency, substitution, scarcity, shadow values, and the consequences of constraints. It can also make distribution visible through endowments and budget sets. Yet an allocation model need not explain how the relevant resource categories were historically produced, how the recipients became recognized as the relevant units, how preferences and capabilities developed, or what happens to resources after allocation as they circulate through relations and generate later capacities.

This boundary is especially important for GRE. A later relation-indexed or generative account of allocation should not be presented as a rejection of welfare economics. It inherits the requirement to specify scarce resources, feasible alternatives, opportunity costs, incentive effects, and efficiency losses. Its extension concerns the object over which evaluation is performed. The eventual question is not only who receives a resource at one moment, but what relations, capabilities, dependencies, institutional feedbacks, and future possibilities that allocation helps generate. That stronger claim

belongs to the substantive GRE chapters rather than to the present genealogy.

### 2.17.5 Information, Incentives, and Allocation Mechanisms

The allocation problem becomes more demanding once information and incentives are treated as endogenous constraints on institutional performance. A planner, market participant, firm, or regulator rarely possesses complete knowledge of preferences, technologies, costs, risks, or future states. Agents may also have reasons to misrepresent private information or alter behavior in response to the rules under which resources are allocated. Twentieth-century economic theory therefore increasingly asks not only whether an allocation is feasible or efficient, but what institutional mechanism can generate desirable outcomes given informational and incentive limitations.

Hayek's account of dispersed knowledge is one major foundation. The economic problem, on this view, is not merely the calculation of an allocation from data already gathered in one mind. Relevant knowledge is divided among individuals and often concerns particular circumstances of time and place (Hayek 1945). Prices can function as signals that permit adjustment without requiring every participant to know the complete structure of the economy. Whether one accepts Hayek's wider institutional conclusions or not, the epistemic point is important: allocation mechanisms differ in the information they require, transmit, aggregate, and leave decentralized.

Coase's theory of the firm establishes a related institutional plurality (Coase 1937). If using the price mechanism is costly, some transactions may be coordinated within organizations through authority and administrative direction. Market and hierarchy are therefore alternative coordination arrangements with different costs and informational structures rather than mutually exclusive descriptions of economic life. Later institutional economics and organizational theory will develop this point further, but its relevance to allocation is already clear: the mechanism through which decisions are made is itself an economic variable.

Hurwicz's work on informationally decentralized systems provides a direct bridge to mechanism design. An allocation mechanism can be analyzed as a rule-governed communication and decision system through which messages, information, and institutional rules produce outcomes (Hurwicz 1972). The later mechanism-design tradition extends this framework by asking which rules can implement desired social objectives when participants possess private information and respond strategically to incentives. The 2007 Nobel scientific background describes this development explicitly as a theory for comparing markets and other institutions under informational and incentive constraints. The conceptual move is substantial: instead of taking an existing market institution as given and predicting its outcome, the institutional rule itself becomes an object of analysis.

This lineage changes the meaning of allocation. Allocation is no longer only a vector of final quantities. It can also be studied as the result of an informational and incentive architecture. Different mechanisms may produce different outcomes from the same underlying resources because they elicit different messages, assign different rights, create different strategic opportunities, and distribute decision authority differently. Markets, firms, auctions, public rules, and other institutions can there-

fore be compared as allocation mechanisms rather than classified simply as more or less “market.”

The neoclassical and mechanism-design traditions consequently supply several resources that later GRE should retain. First, scarcity and opportunity cost discipline claims about what can be jointly realized. Second, marginal reasoning permits analysis of local trade-offs and substitution. Third, equilibrium theory represents mutual consistency and systemic interdependence under explicit assumptions. Fourth, welfare economics distinguishes efficiency from wider normative evaluation. Fifth, information economics and mechanism design show that the rules through which agents communicate and act can determine whether desirable allocations are implementable.

Their characteristic abstractions also identify later questions. Preferences may change through social interaction; technologies and feasible sets can be transformed by investment and institutional change; agents can acquire or lose capabilities; classifications of resources can change; mechanisms can reshape the subjects who participate in them; and an allocation can modify the relations that determine future allocations. These possibilities do not render marginal or neoclassical analysis false. They mark dimensions that often require complementary historical, institutional, relational, and dynamic theories.

The intellectual inheritance for GRE can therefore be stated narrowly. Allocation theory provides rigorous ways to represent scarcity, trade-offs, coordination, efficiency, information, and incentives. GRE's later contribution is not to abandon these questions, but to ask when the units, preferences, constraints, relations, and mechanisms entering an allocation problem are themselves generated and transformed through the economic process. Section 46 thus establishes the allocation-centered lineage that later sections must place alongside historical materialism, institutional economics, capability theory, social reproduction, evolutionary and ecological economics, and the formal sciences of dynamic relational change.

## **2.18 Marxism and Historical Materialism**

Classical political economy made production, accumulation, exchange, and distribution central objects of economic inquiry. Marxism transforms that inheritance by asking how those economic processes are constituted through historically specific social relations and how changes in material production become connected to class formation, consciousness, institutions, political conflict, and social transformation. The role of this section is to reconstruct the principal conceptual lineages of historical materialism that later make generative-relational questions possible. Its objective is neither to present Marxism as a unified doctrine nor to translate Marxist concepts directly into GR vocabulary. The discussion proceeds through material conditions and historical formation, productive forces and relations of production, labor and capital as social relations, the formation of human subjects, and contradiction and historical transformation. The method is genealogical and comparative: Marx's writings are read alongside influential later reconstructions that differ over technological priority, structural causation, historical agency, class, ideology, and contingency.



The term *historical materialism* itself can conceal important internal differences. A minimal shared orientation gives explanatory priority to historically organized material production and reproduction over explanations that derive social order primarily from autonomous ideas. Stronger versions attribute developmental primacy to the growth of productive forces; structural Marxist versions emphasize the articulation of relatively autonomous structures and practices; humanist and historical traditions stress experience, agency, class formation, and struggle; Western Marxist traditions extend the analysis toward reification, hegemony, and consciousness. These positions cannot be treated as simple variants of one causal formula. The conceptual value of the lineage lies partly in the disputes through which its central categories have been repeatedly reinterpreted.

### 2.18.1 Material Conditions and Historical Formation

The materialist orientation developed by Marx and Engels begins from historically situated human activity rather than from an abstract opposition between matter and ideas. In *The German Ideology*, social life is approached through real individuals, their activity, the material conditions under which they live, the division of labor, forms of property, and the changing organization of production (Marx and Engels 1970). Consciousness is therefore embedded in historically specific practical life. Ideas, religion, law, and political forms remain consequential, but their explanation is connected to the social relations through which human beings produce and reproduce their conditions of existence.

This orientation is developed with particular compression in Marx's 1859 Preface to *A Contribution to the Critique of Political Economy*. Marx distinguishes the material productive forces of society from the relations of production within which those forces operate, and he describes the totality of relations of production as an economic structure connected to legal, political, and ideological forms (Marx 1859). The well-known distinction between economic "base" and legal-political "superstructure" became one of the most influential formulations in later Marxism. Yet the Preface should not be read as if it alone provided a complete theory of causal determination. It is a schematic statement written at a particular point in Marx's intellectual development, and later Marxist traditions have disagreed substantially about how strongly to interpret the priority it gives to material production.

The early materialist writings also complicate any interpretation in which human beings merely receive determination from an external economic structure. The *Theses on Feuerbach* criticize contemplative materialism for treating reality only as an object rather than as sensuous human activity and practice; the same text characterizes the human essence as an ensemble of social relations and emphasizes that social life is practical (Marx 1994). Material conditions therefore enter Marx's developing framework through practice. Human beings inherit conditions they did not individually choose, but they also reproduce and transform those conditions through socially organized activity.

Later Marxism has drawn different consequences from these formulations. Cohen's analytical reconstruction gives a particularly systematic role to the development of productive forces and functional explanation in historical materialism

(Cohen 2001). In this reading, relations of production can be explained partly through the way they facilitate or impede the development of productive capacities. Other Marxists resist making technological development the principal motor of history. Wood, for example, argues for a historical materialism attentive to the specificity of social-property relations, class processes, political forms, and the historical constitution of capitalism, while criticizing technological determinism and teleological narratives (Wood 1995). The disagreement is foundational. Historical materialism can be reconstructed as a relatively strong developmental theory, as a method for analyzing socially organized material reproduction, or as a historical research programme centered on the changing relations through which production and appropriation occur.

The concept of material conditions should therefore remain wider than physical technology and narrower than an all-purpose explanation of social life. It can include productive capacities, access to land and resources, labor organization, property relations, infrastructural arrangements, and the institutional conditions through which populations reproduce themselves. The historical-materialist contribution is to insist that these conditions matter for the formation of political and intellectual life while leaving open the precise causal architecture connecting them. That openness becomes important for later GR, but Chapter 2 should preserve it as an inherited theoretical problem rather than close it prematurely.

### 2.18.2 Productive Forces and Relations of Production

The distinction between productive forces and relations of production is one of historical materialism's most influential analytical constructions. Productive forces commonly include labor power, tools, machinery, technical knowledge, organization, and other capacities through which production becomes possible. Relations of production concern socially organized relations among persons in production, including ownership, control, access, command, cooperation, dependence, and appropriation. The distinction enables historical change to be studied through both changing capacities and changing social organization.

Marx's 1859 formulation describes productive forces as developing within definite relations of production and presents historical transformation as becoming possible when existing relations become fetters on further development (Marx 1859). This language strongly influenced stage-theoretic interpretations of history. Yet Marx's mature economic analysis also shows that productive forces and production relations are difficult to isolate empirically. Cooperation, manufacture, machinery, factory organization, and the collective labor process are productive capacities whose operation depends on particular relations of command, property, and wage labor (Marx 1867). Technical capacity is therefore already socially organized. Conversely, property and class relations operate through material infrastructures and productive techniques rather than floating above them.

This interdependence generates an interpretive problem. A productive-force-centered account can treat social relations as selected or transformed because they become more or less compatible with expanding productive capacities. Cohen's reconstruction offers the most philosophically explicit modern defense of this direc-

tion (Cohen 2001). A relation-centered interpretation places greater weight on the historically specific relations through which producers gain access to conditions of production and through which surplus labor is appropriated. Wood's renewal of historical materialism belongs to this second tendency, emphasizing class as a social relation and treating capitalism's distinctive economic dynamics as consequences of historically specific social-property relations rather than as the automatic result of technical advance (Wood 1995).

Structural Marxism introduces another reconstruction. Althusser rejects a model in which every political, ideological, and cultural form simply expresses one economic essence. His concepts of structural causality, social formation, and overdetermination make social contradictions dependent on the articulation of multiple structures and historically specific conjunctures (Althusser 2006). The economic remains important, but causal determination is mediated through political institutions, ideology, national histories, and other relatively autonomous conditions. This approach distances historical materialism from a simple sequence in which productive forces cause production relations, which then mechanically cause the rest of society.

The resulting genealogy makes several separations necessary. Productive forces are not equivalent to technology. Relations of production are not equivalent to formal legal ownership. A mode of production is not merely a list of technologies plus property rules. Historical materialism instead opens a problem concerning the coupling of capacities, ownership, labor organization, control, appropriation, institutional form, and reproduction. Different Marxist schools assign different explanatory priorities within that field.

For later GRE, this is an especially important inheritance because it directs attention toward the conditions under which capacities become socially usable. A machine, body of knowledge, infrastructure, or computational system becomes economically consequential within relations that organize access, authority, labor, ownership, and distribution. The stronger generative question of how those relations and capacities recursively transform one another belongs to later chapters. Here the foundation is the historical-materialist recognition that productive capacity and social organization cannot be analyzed as wholly independent layers.

### 2.18.3 Labor, Capital, and Social Relations

Marxism also changes the analytical status of labor and capital. Within much political economy, labor can appear as a productive input and capital as an accumulated stock or factor of production. Marx retains their material dimensions while reconstructing both through social relations. Wage labor presupposes historically specific conditions under which workers sell labor power and lack independent command over sufficient means of production. Capital similarly refers to more than produced means or accumulated wealth; it operates through social relations that permit value to command labor, appropriate surplus, and reproduce the conditions of capitalist production.

This relational interpretation is already visible in Marx's early economic writings and becomes more systematic in *Capital*. The 1844 manuscripts analyze estranged labor through the worker's relations to the product, productive activity, other per-

sons, and human capacities (Marx 1994). The later theory abandons several formulations of the early manuscripts while retaining the problem of how social relations confront persons in objectified forms. In *Capital*, the analysis of labor power, surplus value, cooperation, machinery, accumulation, and commodity fetishism places relations among producers, owners, and commodities at the center of the capitalist mode of production (Marx 1867).

Commodity fetishism is particularly important for a relational genealogy. Marx argues that the social character of labor can appear in commodity exchange as a relation among things. This does not mean that material objects are unreal or that prices are merely illusions. The analytical point concerns a historically specific form of social mediation in which relations among producers acquire objective economic forms that confront participants as properties of commodities and market relations (Marx 1867). Social relations can therefore become causally effective through objectified forms while their relational origin becomes difficult to perceive.

Class receives a related interpretation. A Marxian class is not exhausted by a descriptive income bracket. Class concerns positions within relations of production and appropriation: who controls conditions of production, who must sell labor power, how surplus labor is extracted, and how those relations are reproduced. Wood makes this point especially strongly by treating class as a process and relation rather than a geological layer of persons possessing similar quantities of assets or income (Wood 1995). Class conflict consequently concerns relations connecting producers and appropriators, even though empirical class formation also depends on political organization, culture, law, gender, race, locality, and historical circumstance.

Lukács extends the relational analysis of commodity society into the problem of reification. In *History and Class Consciousness*, commodity relations and rationalized social forms are connected to modes of consciousness in which historically produced relations acquire the appearance of fixed, thing-like structures (Lukács 1972). Lukács's theory differs from Marx's analysis of commodity fetishism and introduces its own philosophical commitments concerning totality and class consciousness. Its importance for the lineage lies in extending the question from economic relation to the forms through which a social order becomes experienced and understood.

These traditions provide later GRE with a conceptual warning against treating economic entities as analytically self-sufficient. "Labor," "capital," "commodity," and "class" can name stabilized economic categories while simultaneously referring to relations among persons, institutions, rights, productive capacities, and material objects. The relational interpretation does not eliminate entities; it changes the explanatory question from what an entity possesses in isolation to the historically organized relations through which its economic powers and meanings become effective.

#### 2.18.4 Social Relations and the Formation of the Human Subject

Historical materialism also contributes to the problem of subject formation. Marx's early writings reject the image of a timeless individual whose essential characteristics exist prior to social history. The *Theses on Feuerbach* describes the human essence as the ensemble of social relations and criticizes theories that abstract the individual from historical process (Marx 1994). *The German Ideology* similarly situates con-

sciousness, needs, division of labor, forms of intercourse, and practical life within historically specific modes of social organization (Marx and Engels 1970). Human beings remain active participants in history, yet the capacities, categories, dependencies, and conflicts through which they act are socially and materially formed.

The 1844 manuscripts develop this problem through alienation. Estranged labor concerns the worker's relation to the product, the activity of labor, other persons, and human powers, showing how a form of production can shape the subject's relation to self and world (Marx 1994). The later Marx gives less theoretical centrality to the language of species-being, but the general problem survives: economic relations are also formative relations. Wage dependence, factory discipline, commodity exchange, property, and class position organize practical possibilities and forms of consciousness as well as distributions of material resources.

Later Marxism develops this issue in divergent directions. Lukács links capitalist social forms to reification and class consciousness, treating the standpoint of social actors as historically connected to their position within a total social process (Lukács 1972). Gramsci broadens the problem through hegemony, civil society, common sense, intellectual organization, and the state. His *Prison Notebooks* make political and cultural leadership central to the reproduction and transformation of social order, thereby complicating any model in which economic position automatically produces political consciousness (Gramsci 2007). Althusser moves further from humanist formulations by emphasizing ideological practices and structural conditions through which subjects are constituted, a line developed explicitly in his later theory of interpellation and already prepared by his anti-humanist reading of Marx (Althusser 2006; Althusser 2001).

These approaches disagree about the status of the human subject. Humanist Marxist readings preserve alienation, practice, experience, and emancipatory human capacities as central categories. Structural Marxism resists explaining social formations through an already constituted human subject and treats subjectivity itself as an effect of ideological and structural processes. Gramscian approaches give greater weight to political organization, education, culture, and hegemony. Lukács places class consciousness within a dialectical account of totality. The differences are theoretically substantive, particularly for any later framework concerned with whether subjects are constituted through relations while retaining capacities for reflexive transformation.

Thompson's critique of Althusserian Marxism is important in this context. Thompson argues that historical materialism must remain answerable to historical experience, agency, and empirical process rather than replacing history with a self-contained theoretical structure (Thompson 1978). The dispute is useful for Chapter 2 because it exposes a problem that later GR must also confront: a theory of relational constitution can become excessively structural if it cannot explain how historically situated actors interpret, resist, reproduce, and modify the relations through which they were formed.

The historical-materialist inheritance therefore supports a relational account of subject formation without determining a final ontology of the person. Social relations can shape needs, capacities, identities, consciousness, practical horizons, and forms of dependence. This does not by itself establish that persons are reducible to those



relations. The tension between social constitution and practical agency remains one of the central open problems passed forward to GR.

### 2.18.5 Contradiction and Historical Transformation

The final foundational problem concerns historical transformation. Marxist theories frequently explain change through contradiction, but the meaning of contradiction varies across texts and traditions. It can refer to tension between productive forces and relations of production, conflict between classes, contradictory requirements of accumulation, incompatibilities among institutional forms, or dialectical relations in which a social order reproduces conditions that also destabilize it. These meanings should not be collapsed into a single mechanism.

The 1859 Preface gives the canonical developmental formulation: productive forces can come into conflict with existing relations of production, after which the relations that once enabled development become fetters and a period of social transformation becomes possible (Marx 1859). In *Capital*, contradiction appears through more concrete analyses of commodity production, labor and capital, competition, accumulation, machinery, and the reproduction of class relations (Marx 1867). The mature critique therefore does not depend on one abstract contradiction alone; capitalist development involves several interacting mechanisms operating at different institutional and temporal scales.

Later Marxism intensifies the disagreement over how such contradictions produce historical outcomes. Cohen's reconstruction gives a relatively systematic developmental role to productive capacities and the functional adaptation of production relations (Cohen 2001). Althusser argues that historically consequential contradictions are overdetermined by political, ideological, national, and international conditions and are never encountered in a pure form (Althusser 2006). Gramsci's analysis of hegemony and civil society further explains why structural tensions need not generate immediate political transformation: consent, organization, institutions, intellectual leadership, and political strategy shape whether and how conflict becomes transformative (Gramsci 2007). Thompson's historical critique insists in another register that actual historical processes cannot be deduced from theory independently of experience and agency (Thompson 1978).

Wood's reconstruction of historical materialism offers a useful synthesis of some of these concerns without dissolving their differences. Her emphasis on the historical specificity of capitalism, class as a social relation, and the separation of economic and political forms resists both technological determinism and theories in which social transformation follows automatically from structural contradiction (Wood 1995). The historical-materialist question becomes how particular relations of production organize compulsion, appropriation, political power, and possibilities of collective action under determinate historical conditions.

For the later development of GR and GRE, Marxism contributes several indispensable foundations. It makes relations of production historically specific; connects productive capacities to social organization; treats labor and capital as social relations rather than merely physical inputs; shows that social forms can become objectified and causally efficacious; connects subject formation to historically organized prac-



tices; and makes the transformation of social relations an explicit object of theory. At the same time, the Marxist lineage leaves unresolved how much explanatory priority belongs to productive forces, class relations, political organization, ideology, culture, technology, and contingent agency. GR should inherit that unresolved plurality rather than erase it.

The restrained generative-relational extension begins from this inheritance. Historical materialism already asks how one configuration of productive and social relations develops, reproduces itself, encounters limits, and becomes transformable. Later GR can add a more general question concerning how relations generate capacities, subjects, constraints, representations, and further relations, and how those generated elements subsequently alter the conditions of later transformation. That extension should remain distinguishable from Marxism itself. The conceptual continuity lies in treating history, production, social relation, and transformation as constitutive analytical problems; the difference lies in the broader domain and formal vocabulary through which GR will later attempt to study them.

## 2.19 Marxian and Post-Marxian Theories of Circulation and Reproduction

Section 47 reconstructed historical materialism as a family of approaches to material production, social relations, subject formation, and historical transformation. The present section narrows the genealogy to a different but closely connected problem: how capitalist relations persist through circulation and reproduction rather than through production alone. Its role is to recover the conceptual traditions that make value form, the movement of capital, turnover, realization, accumulation, reproduction of total social capital, reproduction of labor-power, and contemporary transformations of capital available as distinct objects of analysis. Its objective is not to present one unified Marxian theory of reproduction. Marx's analysis of capital circulation differs from later value-form reconstruction; debates over accumulation differ from theories of social reproduction; and contemporary accounts of financialization, spatial reorganization, or platform capitalism extend the object in different directions. The discussion therefore proceeds genealogically through value and social form, capital circulation, accumulation and reproduction, social reproduction, and contemporary transformations of capital before identifying a limited inheritance for later GR and GRE.

The term *reproduction* requires particular care. In Marx's economic analysis it can refer to the renewal of the conditions and components of capitalist production, including the reproduction of total social capital across interconnected departments. In later Marxist theory it can also refer to the reproduction of labor-power, class relations, institutions, ideology, households, care arrangements, and other background conditions through which a capitalist social order persists. These usages overlap but are not interchangeable. Likewise, *circulation* is wider than a sequence of market exchanges: it concerns transformations of capital among monetary, productive, and commodity forms, the time required for those transformations, and the conditions under which value is realized and recommitted to a new circuit. Keeping these mean-

ings distinct is necessary if circulation and reproduction are to remain analytical concepts rather than general synonyms for continuity.

### 2.19.1 Value and Social Form

Marx's mature critique of political economy makes value inseparable from historically specific social forms. In the opening chapters of *Capital*, commodities possess use-values but confront one another in exchange through a value relation whose social substance is abstract labor and whose necessary form of appearance develops through exchange-value and money (Marx 1867). This analysis does not treat value simply as an intrinsic physical property of commodities. It asks how privately performed labors become socially related within a commodity-producing society and how those relations acquire objective forms that confront participants through commodities, money, prices, and the requirements of exchange.

Commodity fetishism sharpens the problem of social form. Relations among producers are mediated through things, so the social character of labor becomes expressed through apparently objective relations among commodities (Marx 1867). The theoretical problem is therefore double. Economic forms are socially constituted, yet they are not merely subjective interpretations that disappear once their history is recognized. They organize conduct, constrain reproduction, and mediate access to resources. Social form in this sense refers to a historically specific mode through which relations become objective and practically efficacious.

Rubin's reconstruction makes this dimension of Marx's value theory especially explicit. His *Essays on Marx's Theory of Value* argues that Marx's political economy studies the social form of production relations rather than only their material-technical content. Rubin places commodity fetishism, reification, social labor, and the relation between material categories and production relations at the center of the theory of value (Rubin 1972). On this reading, a category such as value cannot be understood by identifying a physical quantity that commodities possess independently of the social organization through which labor is equated and distributed. Value theory becomes a theory of a specific organization of social labor and of the forms through which that organization becomes expressed.

Later value-form and critical-theory interpretations extend this line in different ways. Postone reconstructs Marx's mature critique around historically specific forms of social mediation, especially commodity, abstract labor, value, and capital. His account gives particular importance to temporality: socially necessary labor time becomes part of an impersonal form of domination in which productivity gains repeatedly transform the temporal standards against which labor is socially validated (Postone 1993). This interpretation differs from approaches that treat labor primarily as an emancipatory standpoint opposed to capital. For Postone, labor under capitalism is itself part of the historically specific social mediation that must be critically explained.

These approaches should not be collapsed. Marx's own presentation, Rubin's value-form reconstruction, and Postone's critical theory assign different explanatory weight to labor, form, class, and historical temporality. They nevertheless establish a common foundational problem for this chapter: economically consequential ob-

jects can possess a material dimension and a social-form dimension simultaneously. Money is a material or symbolic medium, but its economic powers depend on social relations and institutional recognition. A commodity is a useful object or service, but commodity form places it within relations of exchange and valuation. Capital can appear as money, machinery, inventories, claims, or organizational capacities, yet Marxian theory asks under what social relations those heterogeneous elements function as capital.

This distinction becomes important for later GRE because it discourages the treatment of economic categories as context-free entities. The point inherited from value-form theory is not that every economic object is merely linguistic or representational. It is that the causal powers attributed to economic objects may depend on historically organized relations, socially recognized forms, and recurrent practices of valuation. Later GR can generalize the question of how such forms emerge and transform, but the intellectual foundation remains Marxian: social relations can become objectified through forms that are both historically produced and practically real.

### 2.19.2 Capital Circulation

The second volume of *Capital* shifts the analytical center from the immediate production process to the process of circulation. Marx distinguishes the circuits of money-capital, productive capital, and commodity-capital and examines how industrial capital must pass repeatedly through these forms if accumulation is to continue (Marx 1993). Production and circulation are therefore analytically distinguishable but mutually necessary moments of a larger process. Surplus value may be produced through exploitation in production, yet commodities must be sold, monetary value must return, productive inputs must be renewed, and the circuit must be recommenced.

This analysis makes capital less intelligible as a static stock than as a movement through differentiated forms. Money does not function as capital merely because it is held; machinery does not function as capital merely because it is technically productive. Their place in a circuit matters. Money is advanced to acquire labor-power and means of production, productive activity transforms these inputs, commodity-capital must enter circulation, and realized value can then be consumed, hoarded, or advanced again. The unity of the process depends on successful transitions among forms whose temporal and institutional requirements differ.

Turnover introduces time directly into the analysis. Marx distinguishes production time from circulation time and shows that the duration and frequency of turnover affect the quantity of capital that must be advanced and the pace at which surplus value can be realized and recommitted (Marx 1993). Fixed capital creates additional temporal problems because machinery and infrastructure transfer value over extended periods while remaining materially committed to particular productive arrangements. Circulating components are renewed differently. Capital circulation therefore has a temporal architecture: delays, bottlenecks, inventories, credit arrangements, transport, payment practices, and the durability of fixed assets can affect reproduction even when the immediate production process is unchanged.

The distinction between circulation and exchange is consequently important. Ex-

change names a transaction between parties. Circulation concerns the connected movement through which capital changes form and returns to conditions from which another circuit can begin. A particular exchange may be successful while the wider circuit is interrupted. Conversely, institutions such as credit can temporarily bridge discontinuities by allowing production or purchase to proceed before previous values have been fully realized. Marx's circulation analysis therefore opens questions about synchronization, liquidity, turnover, temporal mismatch, and the dependence of productive activity on infrastructures that connect geographically separated moments of the circuit.

Harvey's Marxian reconstruction develops the spatial and temporal implications of this problem. *The Limits to Capital* treats capital accumulation as repeatedly encountering barriers connected to turnover, fixed capital, credit, spatial organization, and the geographical movement of investment (Harvey 1982). Built environments can facilitate accumulation while simultaneously fixing capital in long-lived spatial forms. Credit and finance can coordinate activity across time while also redistributing and intensifying risk. These arguments extend rather than replace Marx's circulation analysis: they ask how capital attempts to overcome spatial and temporal barriers by producing infrastructures and financial arrangements that themselves become conditions of later accumulation.

For Chapter 2, the principal inheritance is conceptual. Capital circulation makes economic continuity a problem of connected transformations rather than of repeated isolated exchange. It also makes time analytically endogenous to economic organization. The capacity to reproduce a process depends not only on quantities of inputs and outputs but on whether heterogeneous moments can be coordinated across time, space, legal form, payment systems, and institutional infrastructures. Later GRE can ask more generally how relations enable or obstruct such transformations, but it should preserve the specific Marxian insight that circulation is a structured process with its own temporal conditions and points of interruption.

### 2.19.3 Accumulation and Reproduction

Accumulation adds a further dimension because capitalist reproduction ordinarily involves more than restoring an unchanged process. In simple reproduction, surplus is consumed while productive activity is renewed on approximately the same scale. Expanded reproduction requires part of the surplus to be converted into additional means of production and labor-power so that production can continue on an enlarged scale. Marx's reproduction schemes in Volume II examine this problem at the level of total social capital, dividing production into departments producing means of production and means of consumption and asking what proportional relations permit their outputs to be mutually renewed (Marx 1993).

These schemes alter the analytical unit. The reproduction of one individual capital does not guarantee the reproduction of the social process as a whole. One firm's output may be another firm's input; workers' consumption participates in the realization of consumer goods; replacement of machinery requires corresponding production elsewhere; and accumulation in one department changes demand for outputs produced in another. Reproduction thus concerns interdependence among capitals

and sectors, not merely the successful continuation of each enterprise considered separately.

Marx's schemes also generated long-standing debates about realization, proportionality, and the sources of demand required for expanded accumulation. Luxemburg's *The Accumulation of Capital* famously argued that Marx's schemes did not adequately explain the realization of surplus value under expanded reproduction within a society composed only of capitalists and workers. She therefore gave non-capitalist environments an essential role in the historical expansion of capitalism and connected accumulation to imperial expansion and the incorporation of external social formations (Luxemburg 2003). Her solution has remained controversial, but the controversy itself is theoretically important because it shows that accumulation raises questions that cannot be reduced to production of surplus value alone.

Accumulation can therefore be approached through several non-equivalent problems. One concerns the production and reinvestment of surplus. Another concerns the realization of commodity values. A third concerns proportional relations among sectors. A fourth concerns the renewal and transformation of fixed capital. A fifth concerns access to labor-power, raw materials, land, credit, and markets. Marxian crisis theories have assigned different explanatory priority to profitability, realization, disproportionality, finance, overaccumulation, and class conflict. Chapter 2 should preserve that plurality rather than present reproduction theory as if it generated one universal crisis mechanism.

Reproduction is also transformative. Expanded accumulation can alter technical composition, firm scale, spatial organization, labor demand, class structure, and the infrastructures on which future production depends. The conditions renewed at the end of a circuit may therefore differ from those at its beginning. This point links reproduction to the process vocabulary reconstructed in Section 39: persistence is compatible with transformation because reproducing a system can involve changing the components and relations through which continuity is maintained. In Marxian theory, capitalist reproduction is especially dynamic because competitive accumulation continually pressures firms to reorganize production, reduce costs, alter technologies, and search for new fields of investment.

The foundational contribution is consequently wider than a model of steady-state renewal. Accumulation and reproduction direct attention to how economic processes regenerate their own conditions while changing scale, composition, and interdependence. Later GRE will require a more general vocabulary for generative relations, value conversion, and the transformation of the conditions of subsequent transformation. Section 48 does not introduce that vocabulary as if it were already contained in Marx. It identifies a prior theoretical achievement: Marxian political economy made the reproduction of the conditions of economic activity an explicit object of analysis.

#### 2.19.4 Social Reproduction

The concept of social reproduction extends the problem beyond the renewal of industrial capital. Even Marx's economic analysis requires the recurrent availability of labor-power, means of subsistence, legal and monetary institutions, and social rela-

tions through which workers and owners re-enter the circuit. Later Marxist and feminist traditions ask more explicitly how these conditions are reproduced and how their costs are distributed. The extension is substantial because it moves attention from the continuity of capital to the reproduction of persons, capacities, institutions, and social relations that capitalist production presupposes.

Althusser formulates one influential version by arguing that every mode of production must reproduce the conditions of production, including productive forces and existing relations of production. His essay on ideological state apparatuses therefore links schools, families, legal institutions, political organizations, media, and other institutions to the reproduction of labor-power, skills, submission to rules, and social relations (Althusser 1971). This is not the same problem as Marx's reproduction schemes. Althusser is concerned with how a social formation reproduces the capacities and relations needed for its continued functioning, including ideological conditions that cannot be represented simply as flows between economic departments.

Feminist social-reproduction theory shifts the problem again. Vogel reconstructs Marxist theory around the production and reproduction of labor-power, asking how generational replacement, daily maintenance, domestic labor, households, and gender relations connect to capitalist production (Vogel 1983). Her unitary approach resists treating capitalism and patriarchy as entirely separate systems whose interaction must be explained only after each has been independently theorized. Instead, it examines how the reproduction of labor-power creates a necessary but historically variable relation between capitalist production and forms of socially organized reproductive labor.

This extension also reveals limits in analyses that treat the wage relation as if it contained all conditions needed for its own renewal. Labor-power must be maintained biologically and socially; new generations must be raised; people require care during childhood, illness, disability, and old age; capacities must be learned; and households and public institutions distribute these activities in historically variable ways. Some of this labor is commodified and waged, some organized through states, some performed within households, and some sustained through communities or informal relations. The category of social reproduction therefore directs attention to activities whose economic importance may exceed their representation in market price or conventional production accounts.

Fraser broadens the argument still further by treating capitalist economy as dependent on background conditions that include social reproduction, ecological reproduction, and public power. Her proposal understands capitalism as an institutionalized social order whose officially economic mechanisms depend on domains that are institutionally differentiated from commodity production yet repeatedly drawn upon by accumulation (Fraser 2014). This perspective turns the boundary between production and its background conditions into a historical and political object. It also introduces the possibility that accumulation can destabilize the very reproductive capacities on which it depends.

These traditions should remain differentiated. Marx's reproduction of total social capital, Althusser's reproduction of productive and ideological conditions, Vogel's theory of the reproduction of labor-power, and Fraser's expanded account of capitalism's background conditions address overlapping but distinct problems. Section



51 will later examine care, feminist economics, and social-reproduction economics in greater depth. The present section needs only to establish why reproduction cannot be confined to the circulation of commodity values if the continued availability of persons, institutions, ecological conditions, and social capacities is part of the explanandum.

For later GRE, this literature provides an especially important warning. An economic process can appear self-reproducing when analytical boundaries externalize part of the work that renews its conditions. The relevant question is therefore not simply whether a circuit closes within a chosen model, but which conditions have been assumed, displaced, subsidized, depleted, or reproduced elsewhere. GR can later formulate this as a boundary-sensitive problem of generative dependence, but its foundation lies in long-standing Marxian and feminist disputes over what capitalist reproduction requires.

### 2.19.5 Contemporary Transformations of Capital

Post-Marxian theories have also asked how the forms through which capital circulates and reproduces itself change historically. The problem is not merely that capitalism expands quantitatively. Financial institutions, corporate organization, state capacities, global production networks, infrastructures, technologies, and forms of ownership can alter the routes through which value is advanced, realized, appropriated, and reinvested. The category of capital therefore remains historically specific even within capitalism: recurrent accumulation can transform the organizational forms through which later accumulation occurs.

Harvey's account emphasizes geographical and temporal reorganization. Capital seeks ways of overcoming barriers to accumulation through investment in infrastructures, urbanization, credit, geographical expansion, and other spatial-temporal arrangements (Harvey 1982). These arrangements can open new fields of accumulation while immobilizing resources in fixed capital and producing new dependencies. Spatial reorganization is therefore neither external to circulation nor a simple movement of already constituted economic entities across a neutral map. Capitalist development produces built environments, transport systems, property relations, and credit structures that alter the conditions of later movement.

Arrighi places financial expansion within a much longer historical sequence. *The Long Twentieth Century* analyzes successive systemic cycles of accumulation in which material expansion and financial expansion are connected to changing centers of state and economic power (Arrighi 1994). His argument differs from Marx's reproduction schemes and from Harvey's geographical political economy, but it extends the circulation problem toward world-historical transformations in the organization of money, state power, and accumulation. Financial expansion becomes one recurrent phase within a historical pattern rather than simply a sectoral increase in banking activity.

The modern financialization literature further specifies changes in the sources and organization of profit. Krippner's historical sociology of the United States defines financialization through the growing importance of financial activities relative to production and traces this transformation through deregulation, international capital

flows, and monetary-policy changes from the 1970s onward (Krippner 2011). Her explanation is especially useful because it resists treating financialization as an automatic technological stage. Policy responses to political and distributive dilemmas helped produce institutional changes whose cumulative consequences transformed the economy. Financialization can therefore be studied as historically generated rather than assumed as the inevitable maturation of capital.

Digital platforms introduce another organizational form. Srnicek describes platforms as businesses that provide infrastructures on which other actors interact and identifies data extraction, network effects, cross-subsidization, and platform control as characteristic features of several contemporary business models (Srnicek 2016). Platform capitalism does not abolish earlier problems of labor, ownership, circulation, competition, or finance. It changes some of the infrastructures through which transactions, attention, information, logistics, and market access are coordinated. A platform can therefore become both an intermediary within circulation and an object of accumulation whose control reorganizes relations among users, workers, advertisers, producers, and complementary firms.

These contemporary approaches do not form a single post-Marxian theory. Harvey emphasizes spatial and temporal barriers, Arrighi long systemic cycles and financial expansion, Krippner historically specific institutional financialization, and Srnicek platform-centered business models. Their scales, mechanisms, and explanatory commitments differ. Taken together, however, they sustain the older Marxian question in a transformed context: capital is reproduced through historically variable organizational and institutional forms, and those forms can change the conditions under which subsequent accumulation occurs.

Several distinctions can therefore be carried forward. Capital circulation is not identical to commodity exchange. Accumulation is not identical to a larger stock of physical assets. Reproduction is not equivalent to equilibrium or stasis. Social reproduction is not reducible to the reproduction of total social capital. Financialization and platformization are historically specific transformations rather than universal stages through which every economy must pass. Each concept identifies a different mechanism through which continuity and transformation can become connected.

The restrained GR/GRE inheritance lies in this connection between circulation, reproduction, and transformation. Marxian and post-Marxian theories make it possible to ask how value forms, temporal circuits, sectoral interdependencies, labor-power, institutions, infrastructures, and background conditions are renewed through economic activity and how that renewal alters the conditions of the next cycle. Later GRE can extend the problem toward heterogeneous value conversion, generative return, capture, dissipation, regeneration, and relations that transform the mechanisms of subsequent relation formation. That extension should remain analytically distinguishable from the traditions reconstructed here. The achievement of the Marxian lineage is prior and foundational: it makes the reproduction of economic and social conditions, rather than production of outputs alone, a central object of political-economic inquiry.

## 2.20 Institutional Economics and Economic Sociology

Sections 45–48 reconstructed several major economic lineages through wealth, allocation, historical materialism, circulation, and reproduction. The present section turns to traditions that made the institutional and social organization of economic action itself a primary object of inquiry. Its role is to recover the conceptual resources through which economists and sociologists came to analyze firms, rules, conventions, networks, trust, collective action, organizational fields, and historically persistent institutional arrangements as constitutive conditions of economic coordination rather than as residual background. Its objective is genealogical rather than synthetic. Old institutional economics, new institutional economics, economic sociology, and sociological institutionalism differ in their units of analysis, explanatory mechanisms, and assumptions about action. The discussion therefore proceeds through institutions and coordination, rules and conventions, embeddedness, trust and social capital, and institutional change before identifying a limited inheritance for later GR and GRE.

The term *institution* is unusually heterogeneous across these traditions. For Commons, institutions are forms of collective action that control, liberate, and expand individual action; for North, they are humanly devised constraints structuring interaction; for Williamson, the institutional environment must be distinguished from governance arrangements; for Ostrom, rules-in-use configure action situations and collective governance; and in sociological institutionalism, institutional environments can shape organizational forms through legitimacy, professionalization, imitation, and normative expectation. Economic sociology introduces a further shift by asking how ostensibly economic action remains embedded in social relations and networks. These approaches overlap in rejecting an economy composed only of isolated choices under fixed rules, yet they should not be treated as equivalent theories of institutions.

### 2.20.1 Institutions and Economic Coordination

American institutional economics developed partly through dissatisfaction with economic theory that treated preferences, technologies, and institutional settings as fixed givens. Veblen's 1898 critique of economics as insufficiently evolutionary called for an account of economic life as a cumulative process in which habits of thought, institutions, technologies, and conduct develop historically rather than appearing as timeless elements of a static taxonomy (Veblen 1898). His institutionalism therefore differs from later approaches that introduce institutions chiefly as constraints surrounding otherwise stable optimizing agents. Institutions, habits, and technological practices participate in the formation of economic conduct itself.

Commons developed a different institutionalist architecture. In his account, the relevant unit is not merely an isolated individual or commodity but the *transaction*, situated within working rules and collective action. Institutions organize bargaining, managerial, and rationing transactions; collective action can constrain individual conduct while also enabling capacities that isolated actors would not possess (Commons 1931). This perspective places law, custom, organizations, bargaining power, and authorized forms of collective control inside economic analysis. Coordination is therefore neither reducible to prices nor external to legal and organizational arrange-

ments.

The later new institutional economics begins from a different analytical starting point. Coase's theory of the firm asks why economic coordination occurs through firms when market exchange is available and identifies costs associated with using the price mechanism as part of the answer (Coase 1937). The firm can thereby be studied as an alternative coordination arrangement rather than simply as a production function. Williamson extends this line by treating firms and contracts as governance structures and distinguishing the broader institutional environment from more immediate institutions of governance (Williamson 2000). Transaction characteristics, contractual incompleteness, adaptation, and governance become central to explaining why different forms of coordination arise.

North similarly makes institutions central to economic performance, defining them as humanly devised constraints that structure interaction and shape incentives under uncertainty (North 1990). His framework differs from Commons's transaction-centered institutionalism and from Veblen's evolutionary emphasis on habituation. It is nevertheless important for the transition from allocation under fixed rules to analysis of the rules themselves. Property rights, political arrangements, enforcement, informal constraints, and organizations can influence the costs and possibilities of exchange, investment, and coordination over long periods.

Ostrom's institutional analysis further expands the range of coordination arrangements. Her studies of common-pool resources show that durable governance need not be represented through a simple opposition between private markets and centralized state command. Communities can construct monitoring arrangements, rules, sanctions, conflict-resolution procedures, and nested forms of governance adapted to particular resource conditions (Ostrom 1990). Her later Institutional Analysis and Development framework treats rules, community attributes, material conditions, and action situations as analytically separable components whose configurations shape interaction (Ostrom 2005). The foundational lesson is not that one institutional form is universally superior. It is that coordination problems can be organized through heterogeneous institutional architectures whose performance depends on context, rule configuration, information, enforcement, and participant capacities.

These traditions thus enlarge the concept of economic coordination beyond price-mediated allocation. Markets, firms, associations, households, public agencies, commons, contracts, and hybrid arrangements can all coordinate economic activity, while the rules under which they operate remain part of the explanation. For later GRE, this inheritance is important because it permits economic architecture to be treated as an object of inquiry. The present section does not yet ask how such architectures are generatively produced; it establishes first that economic outcomes cannot always be explained adequately while institutional forms are held constant.

### 2.20.2 Rules, Conventions, and Economic Action

Institutional analysis also changes the status of rules. In a purely parametric representation, rules can appear as fixed external restrictions on action. Institutional theories instead ask how rules are recognized, interpreted, enforced, contested, and reproduced in practice. Commons's *working rules* are especially important in this

respect: they emerge from collective action and define practical permissions, duties, powers, exposures, and expectations within transactions (Commons 1931). Economic conduct therefore depends on an organized normative and legal environment rather than on material incentives alone.

North distinguishes formal rules from informal constraints and emphasizes that both can structure incentives and expectations (North 1990). Formal constitutional or legal change can occur rapidly, while informal conventions, norms, and enforcement practices may change slowly. This difference helps explain why formally similar rules can produce different outcomes across societies and why institutional reform cannot be inferred from legislative text alone. The effective institution includes the relation between written rules, informal expectations, enforcement, and organizations capable of acting upon them.

Ostrom provides a still more fine-grained account by distinguishing rules-in-form from rules-in-use and by analyzing how different rule types configure positions, boundaries, choices, information, payoffs, and aggregation within action situations (Ostrom 2005). Rules are consequently neither mere descriptions of repeated behavior nor simply commands backed by centralized sanction. Their operation depends on shared understanding, monitoring, enforcement, and the practical setting in which participants interpret them. Institutional diversity arises partly because different communities combine these elements differently.

Economic sociology and organizational theory add a further dimension: action can be oriented toward legitimacy and convention as well as calculable efficiency. DiMaggio and Powell's analysis of organizational fields identifies coercive, mimetic, and normative processes through which organizations become more similar even when similarity cannot be explained solely by competitive efficiency (DiMaggio and Powell 1983). Dependence on states or powerful organizations, uncertainty that encourages imitation, and professional norms can all stabilize organizational forms. Institutional regularity may therefore be reproduced because an arrangement is taken as legitimate, normal, or professionally appropriate rather than because each participant has independently calculated it to be technically optimal.

This literature requires a distinction among *rule*, *convention*, *norm*, and *institution*. A rule specifies or structures conduct; a convention may stabilize mutual expectations around one among several possible practices; a norm adds social expectations and evaluative force; an institution can incorporate rules, conventions, roles, enforcement, symbolic classifications, and organizational capacities. The categories overlap in particular cases but are not synonyms. An institution may contain explicit rules while depending on informal conventions for interpretation, and a convention can remain operative without becoming a legally codified rule.

For later GR and GRE, the important inheritance concerns the practical generation of regularity. Economic action occurs within fields of permissions, expectations, classifications, and institutionalized meanings that can shape which actions are intelligible, feasible, legitimate, or sanctionable. Chapter 2 should not yet convert this observation into a general generative theory. Its foundational task is to establish that rule-governed economic action cannot be understood fully by observing choices while ignoring the historically formed rule systems and interpretive practices through which those choices become possible.



### 2.20.3 Embeddedness

The concept of embeddedness connects institutional economics to economic sociology, but it carries more than one historical meaning. Polanyi's account of the *great transformation* argues that the self-regulating market represents a historically specific institutional project in which land, labor, and money are increasingly organized through market mechanisms. Earlier economies, in his reconstruction, were more visibly instituted through reciprocity, redistribution, householding, political authority, and social obligation; the nineteenth-century market order attempted an exceptional degree of institutional separation of economic processes from other social relations (Polanyi 1944). Embeddedness here concerns the institutional place of the economy within society and the historical transformation of that relation.

Granovetter's influential 1985 formulation addresses a different problem. His target is both an undersocialized image of atomized actors and an oversocialized image in which behavior follows internalized norms independently of concrete relational structure. Economic action, he argues, is embedded in ongoing networks of social relations (Granovetter 1985). Trust, information, reputation, opportunism, and access to opportunities can depend on actual patterns of interpersonal and interorganizational connection. The concept therefore moves from a macrohistorical question about the institution of the economy toward a relational account of action within social networks.

These two meanings should not be collapsed. Polanyi's embeddedness concerns the historical-institutional organization of economy and society; Granovetter's concerns the relational location of action within concrete social ties. They can complement one another, but they answer different questions. A market can be institutionally central within a society while individual transactions remain deeply network-embedded. Conversely, identifying dense networks does not by itself explain the legal, political, and institutional order through which markets are constituted.

Network organization also complicates the classical market-hierarchy dichotomy. Powell identifies network forms characterized by recurrent exchange, reciprocal communication, reputation, and interdependence that are not well described as either discrete market transactions or hierarchical command (Powell 1990). Networks can support learning, joint problem solving, and coordination where knowledge is distributed and relationships are persistent. Their operation depends on social structure, however, and does not imply harmony: network position can create exclusion, dependency, brokerage advantages, and unequal access.

Embeddedness therefore changes the object of economic explanation. Prices and contracts remain important, but their effects may depend on who is connected to whom, which relations carry information, how reputation travels, what institutional environments authorize exchange, and which actors can enter relevant networks. The concept also limits methodological individualism without requiring the disappearance of individual agency. Actors choose and strategize, yet they do so from positions in relational structures that shape information, expectations, opportunities, and exposure to sanctions.

The later GR/GRE significance is again prospective. Embeddedness provides a foundation for treating economic action as relationally situated, but it does not yet es-



establish a theory of how actors and networks co-generate one another, how relations among networks form, or how economic fields transform over time. Those stronger questions belong to later sections. Here the lineage establishes that the economic actor cannot always be modeled adequately as if social relations entered only after preferences and opportunities were already formed.

#### **2.20.4 Trust, Reciprocity, and Social Capital**

Institutional coordination often depends on expectations that cannot be reduced to complete contracts or continuous external enforcement. Trust, reciprocity, reputation, and social capital became important concepts for explaining how cooperation can be sustained when monitoring is costly, information is incomplete, or future interaction matters. These concepts are related but analytically distinct. Trust concerns an expectation that vulnerability will not be exploited under specified conditions; reciprocity concerns patterns of response to prior action; reputation concerns socially transmitted information about past conduct; social capital refers to resources made available through social relations and structures.

Coleman's formulation of social capital is deliberately positioned between rational action and social structure. He treats social capital as a resource for action located in relations among persons rather than as a property contained within an isolated individual. Obligations and expectations, information channels, social norms, and structural closure can make certain actions possible or less costly (Coleman 1988). The concept therefore illustrates a broader analytical move important for economic sociology: resources can be relationally located. Two actors with similar individual attributes may possess different capacities because their positions in networks of obligation, information, and trust differ.

Ostrom's behavioral research on collective action gives trust and reciprocity a more explicitly dynamic role. Experimental and field evidence led her to criticize models that rely exclusively on narrowly self-interested complete rationality in social dilemmas. Reciprocity, reputation, and trust can reinforce one another and help participants sustain cooperation under conditions in which short-run incentives alone would predict defection (Ostrom 1998). The mechanism is conditional rather than universal. Trust can be destroyed; reciprocity can be negative; reputations can be manipulated; and cooperative arrangements can fail when monitoring, communication, or sanctioning conditions deteriorate.

Granovetter's network account also helps explain why trust is neither simply a moral disposition nor a substitute for structure. Ongoing relations can generate information about conduct and raise the costs of opportunism, but the same embedded relations can support fraud, collusion, exclusion, or capture (Granovetter 1985). Dense social connection is therefore not equivalent to desirable coordination. Similarly, Powell's network forms depend on reputation and recurrent ties, yet their effectiveness is contingent on the distribution of knowledge, dependence, and relational position (Powell 1990).

The social-capital literature consequently introduces a normative caution. If social capital is defined only by its capacity to facilitate action, then the actions facilitated may benefit one group while excluding others. Closure can strengthen internal coop-

eration while raising barriers to outsiders. Trust within a network can coexist with distrust across networks. Reciprocity can reproduce unequal obligations. The existence of relational resources therefore does not itself establish justice, efficiency, or social desirability.

For GRE, these traditions are foundational because they show that economically consequential capacities can emerge from relations rather than being reducible to assets owned by isolated agents. They also provide early examples of self-reinforcing relational dynamics: repeated trustworthy conduct can support reputation, reputation can support trust, and trust can make further cooperation possible. Chapter 2 should nevertheless resist turning that pattern immediately into GR's later theory of relational attractors or self-reinforcing realities. At this stage, the literature establishes the mechanisms and empirical objects from which such later questions can responsibly develop.

### 2.20.5 Institutional Change and Path Dependence

Institutional theory must explain persistence without treating institutions as immutable. North places institutional change at the center of long-run economic performance and emphasizes the interaction of formal rules, informal constraints, organizations, incentives, and learning (North 1990). Organizations adapt within an institutional framework while also becoming agents of institutional change. Because present choices are made under inherited rules and beliefs, institutional development is cumulative: existing arrangements shape the costs and possibilities of changing them.

The economics of path dependence provides more specific mechanisms for such historical dependence. David's analysis of QWERTY emphasizes technical interrelatedness, scale economies, and quasi-irreversibility as mechanisms through which early sequences can affect later technological trajectories (David 1985). Arthur formalizes related processes in settings with increasing returns, where adoption can reinforce the attractiveness of an already selected technology and make historically contingent events consequential for later outcomes (Arthur 1989). These contributions concern technology selection rather than institutions in general, but they provide analytical resources for distinguishing path dependence from the weaker claim that history matters.

Pierson extends increasing-return reasoning into political and institutional development, emphasizing timing, sequence, coordination effects, adaptive expectations, and the costs of reversing established arrangements (Pierson 2000). Institutional persistence can thus arise because an arrangement generates constituencies, complementary organizations, learned practices, sunk investments, or expectations that make alternative trajectories progressively more costly. Path dependence does not mean that change is impossible; it means that the probability and cost of later transitions depend partly on the sequence through which the current arrangement was produced.

Sociological institutionalism identifies different mechanisms of persistence and change. DiMaggio and Powell show that organizational similarity can emerge through coercive, mimetic, and normative pressures within organizational fields

(DiMaggio and Powell 1983). Such processes can stabilize forms that actors adopt for legitimacy or uncertainty reduction rather than because they are uniquely efficient. Institutional change may therefore involve shifts in professional standards, regulatory environments, field composition, models available for imitation, or the sources from which legitimacy is conferred.

Old institutionalism adds another historical dimension. Veblen's evolutionary orientation treats habits, institutions, technologies, and economic conduct as mutually conditioning elements of cumulative change (Veblen 1898). Commons places conflict, bargaining, legal development, and collective action inside institutional evolution (Commons 1931). These approaches do not offer the same mechanism as increasing-return models. Their importance lies in refusing to treat institutional change as an external shock applied to an otherwise stationary economy.

The conceptual inheritance for later GR and GRE can therefore be stated cautiously. Institutional economics and economic sociology establish that economic action is coordinated through historically variable architectures of rules, organizations, networks, expectations, authority, and relational resources. They also show that these architectures can persist through feedback, legitimacy, learning, complementarity, reputation, and increasing returns while remaining open to conflict and transformation. What they do not jointly provide is one unified account of how institutions, actors, relations, and capacities generate one another across levels. Later GR may formulate that broader problem, while GRE can ask how institutional configurations transform economic possibility, value creation, access, coordination, and distribution. The foundation supplied here is prior and more modest: institutions and social relations are constitutive explanatory objects, and their histories belong inside economic analysis rather than outside it.

## 2.21 Relational Sociology and Social Field Theory

Section 49 established that institutions, rules, conventions, networks, and relational resources can belong inside economic explanation rather than being treated as an external social background. The present section turns to sociological traditions that make relations and positions still more explicit objects of analysis. Its role is to reconstruct the intellectual resources through which actors, identities, structures, fields, and power came to be understood through patterns of interdependence rather than through attributes alone. Its objective is genealogical. Relational sociology, network analysis, figurational sociology, Bourdieuan field theory, and strategic-action-field theory do not share one ontology or one method. The discussion therefore proceeds through the relational constitution of actors, positions and structures, social fields, power, and dynamic multilevel relations before identifying a limited inheritance for later GR and GRE.

The vocabulary of this literature requires restraint because several terms can appear similar while carrying different theoretical commitments. A *relation* may refer to an interaction, an interdependence, a social tie, a structural equivalence, a constitutive dependence, or a position within a field. A *network* represents actors and ties without necessarily specifying a field's stakes, rules, or forms of capital. A *field*

identifies a structured social arena in which positions acquire meaning through relations to other positions, but field theories differ over the mechanisms that generate action and change. Relational analysis can therefore challenge substantialist explanation without committing sociology to a relation-only metaphysics. The value of the lineage lies in the analytical shift from isolated attributes toward patterned dependence, position, and interaction.

### 2.21.1 Relational Constitution of Social Actors

One important precursor appears in Simmel's attempt to define a distinctive object for sociology. Rather than treating society as an entity standing above individuals, Simmel analyzed recurrent *forms of interaction* through which association becomes socially patterned. Exchange, conflict, domination, sociability, group membership, and social types such as the stranger are intelligible through relations among participants and through the forms those relations assume (Simmel 1971). This does not dissolve individuals into relations. Simmel's work instead makes individuality and association mutually relevant: participation in multiple circles of interaction can differentiate persons while simultaneously locating them within social forms.

Elias develops a more explicitly processual rejection of the opposition between isolated individual and external society. His concept of *figuration* directs attention to changing configurations of interdependent people whose actions constrain and enable one another over time (Elias 1978). Individuals possess relative autonomy, but their opportunities, dependencies, habits, and power chances are formed within webs of interdependence that no single participant controls. A figuration can persist while particular participants change, yet it cannot exist independently of interdependent people altogether. Elias consequently provides a relational language that is neither methodological individualism nor a reification of society as a supra-individual substance.

These ideas become more explicit in later relational sociology. Emirbayer contrasts substantialist approaches, which begin from pre-given entities bearing properties, with relational approaches that treat social processes and transactions as primary explanatory objects (Emirbayer 1997). His intervention is methodological and programmatic rather than a single empirical theory. The important inheritance is the demand that actors and social units should not always be assumed to possess all analytically relevant identities and capacities prior to the relations under investigation. Some properties may be constituted, activated, or transformed through transactions.

Harrison White's network sociology develops a different mechanism. In *Identity and Control*, identities and social formations emerge under conditions of uncertainty through attempts at control, interaction, and networked social organization (White 2008). Here an identity is not merely an inner essence later connected to other identities. Social formations arise through recurrent relations, stories, disciplines, and control efforts. White's framework is considerably more specific than the general claim that persons are relationally constituted; it supplies a network-oriented account of how identities and social forms can stabilize and shift.

These traditions establish several possible meanings of relational constitution. Simmel emphasizes forms of interaction; Elias emphasizes interdependence and long-

term figurations; Emirbayer emphasizes transactional and processual explanation; White develops identities and control within networked formations. They should not be collapsed into one thesis that actors have no properties apart from relations. A more defensible foundation is conditional: some identities, capacities, dispositions, opportunities, and constraints can only be adequately explained when the relations through which they are produced or sustained are included in the analysis.

For later GRE, this matters because economic actors need not always enter analysis as fully constituted bearers of fixed preferences and capacities. Employment relations can form skills and expectations; credit relations can reorganize future options; organizational membership can confer authority; markets can classify participants and create reputational identities. The present chapter does not yet offer a GR theory of actor generation. It establishes that sociology already contains substantial resources for treating actorhood itself as partly relationally conditioned.

### 2.21.2 Positions and Relational Structures

A second lineage shifts attention from direct interaction to *position*. Network analysis is important because it distinguishes a person's attributes from the person's location within a patterned set of relations. Wellman's formulation of network analysis emphasizes structured relations among individuals and collectivities, complex network patterns, boundaries, clusters, reciprocal ties, and systems of power and dependency rather than aggregate characteristics considered independently of connection (Wellman 1983). A relational structure can therefore generate differences among actors who appear similar when described only by individual attributes.

Breiger's analysis of the duality of persons and groups provides an especially clear example. Shared memberships generate a dual structure: persons are related through the groups in which they participate, while groups are related through overlapping memberships (Breiger 1974). The same membership data can consequently be viewed from the side of actors or collectivities. This does not imply that persons and groups are ontologically identical. It demonstrates that one relational system can produce analytically linked structures at more than one level.

White, Boorman, and Breiger extend network analysis from individual ties toward roles and positions. Their blockmodel approach identifies sets of actors occupying similar relational locations across multiple types of ties and uses those patterns to interpret role and position structures (White et al. 1976). Position is therefore not simply rank on a scalar hierarchy. It can refer to a pattern of relations connecting one class of actors to other classes of actors. Two persons can occupy structurally similar positions even when they are not directly connected to one another.

This distinction between tie and position is foundational. A tie records or represents a specified relation between actors. A position summarizes how an actor or class of actors is situated within a broader relational pattern. A structure organizes multiple positions and relations. None of these concepts by itself establishes the meaning, legitimacy, or causal mechanism of the relation observed. A friendship network, interlocking directorate network, supply network, communication network, and authority structure can share formal properties while differing substantially in social content.



Bourdieu's relational sociology approaches position through a different theoretical architecture. His work links objective positions, distributions of forms of capital, habitus, and practice rather than treating social structure as a network of observed ties alone. Bourdieu and Wacquant explicitly describe this orientation as methodological relationalism and make "thinking relationally" central to sociological analysis (Bourdieu and Wacquant 1992). Positions gain significance through differences and relations within a structured space; the effects of capital depend on the field in which it is recognized and can be mobilized. This produces a relational theory of social differentiation that cannot be reduced to network topology.

The distinction among *tie*, *position*, *role*, *structure*, and *field position* should therefore remain explicit. Network analysis often reconstructs position from patterned ties. Bourdieu reconstructs positions through distributions of capital and relations within fields. Elias describes power chances within changing figurations. These approaches can sometimes illuminate the same empirical object, but they encode different explanatory questions.

For economic analysis, the implication is substantial. A firm's capabilities cannot always be inferred from its internal assets if access to suppliers, information, finance, standards, distribution channels, or political authority depends on relational position. Likewise, a worker's opportunities can depend on network location, organizational membership, occupational field, credential recognition, or bargaining position. Relational structure thus adds a level of explanation between individual attributes and aggregate outcomes without requiring that every economic phenomenon be re-described as a network.

### 2.21.3 Social Fields

Field theory introduces a different way of organizing relational explanation. In Bourdieu's sociology, a field is a relatively structured arena of positions and position-takings in which actors and institutions struggle over stakes and over the forms of capital that possess efficacy within that arena. Field, habitus, and capital are mutually articulated rather than independent variables added after the fact (Bourdieu and Wacquant 1992). An actor's practices depend partly on dispositions acquired through history and partly on the actor's current position within a field whose structure is itself historically produced.

This approach prevents field from becoming a synonym for social context. A field has differentiated positions, stakes, distributions of resources, principles of evaluation, and forms of struggle. The same resource may possess different value across fields because recognition and convertibility vary. Cultural capital, scientific authority, economic capital, legal competence, or political access do not operate identically in every arena. Field analysis therefore links relational position to historically specific rules of relevance and forms of power.

Martin's reconstruction of field theory helps clarify the general explanatory ambition while also revealing its limits. He describes field theory as explaining regularities in action through an actor's position relative to others, with field forces understood through the structured relations of the field rather than as external commands alone (Martin 2003). His analysis also emphasizes that "field theory" names a family of ap-



proaches rather than one fully standardized model. Physical-field metaphors can be analytically productive, but sociological fields do not automatically inherit the mathematical or ontological properties of physical fields.

Fligstein and McAdam develop another field tradition through the concept of the *strategic action field*. Their framework describes mesolevel social orders in which actors possess shared understandings about purposes, positions, rules, and legitimate action, while incumbents and challengers occupy asymmetrical locations (Fligstein and McAdam 2012). Social skill concerns the capacity to induce cooperation and construct shared meanings. Fields can emerge, stabilize, enter crisis, and transform; they can also be embedded within wider systems of fields rather than existing as isolated arenas.

The Bourdieuan and strategic-action-field traditions overlap in taking mesolevel relational arenas seriously, but they differ in vocabulary and emphasis. Bourdieu gives sustained attention to habitus, capital, symbolic power, reproduction, and the homology between social and mental structures. Fligstein and McAdam emphasize incumbents, challengers, governance units, social skill, exogenous shocks, field settlements, and inter-field dependence. Treating them as interchangeable would hide the theoretical work done by those differences.

Several conceptual separations follow. A field is not merely a network because field analysis usually includes stakes, evaluative principles, positions, and forms of power in addition to ties. A field is not simply an institution because multiple institutions and organizations may inhabit one field, while a single organization can participate in several fields. A field is not equivalent to a market, although markets can be studied as fields. Finally, field language does not establish that all social reality is field-structured.

For GRE, field theory supplies a useful foundation for examining economic arenas in which value, legitimacy, competence, and authority depend on position and on historically formed rules of recognition. Yet Chapter 2 should stop before converting this foundation into GR's later field-governance language. The established literature first shows that economic possibilities can be organized through structured arenas whose participants, stakes, and resources acquire meaning relationally.

#### **2.21.4 Power and Relational Position**

Relational sociology also changes the analysis of power. If opportunities and constraints depend on position, power cannot always be represented as a quantity possessed independently by an actor. Elias treats power through changing balances of dependence within figurations. Because interdependent actors need resources or actions from one another to different degrees, power differentials emerge from asymmetric dependencies rather than from an attribute called power residing inside one party (Elias 1978). The balance can change when dependencies, coalitions, alternatives, or institutional arrangements change.

Network analysis offers related but more formal possibilities. A position can matter because it controls access, bridges otherwise separated groups, lies on important paths of communication, or belongs to a structurally advantaged pattern of relations. Wellman's network perspective explicitly includes power, dependency, and coordi-

nation among the problems that relational structures can illuminate (Wellman 1983). Such accounts need not claim that network position exhausts power. Legal authority, material force, ownership, expertise, ideology, and institutional rules can generate power through mechanisms not reducible to topology.

Bourdieu develops power through field-specific and convertible forms of capital. Economic, cultural, social, and symbolic resources become effective according to the structure and history of the field, while symbolic power depends partly on recognition and misrecognition of legitimate classifications (Bourdieu and Wacquant 1992). Power is therefore relational in at least two senses: the value of resources depends on a structured arena, and domination concerns the relative positions from which actors can define legitimate distinctions, categories, and stakes.

Fligstein and McAdam place positional asymmetry directly inside strategic action fields. Incumbents generally possess greater influence over the existing settlement, while challengers have less advantageous positions; internal governance units can help reproduce field rules and stability (Fligstein and McAdam 2012). Their account nevertheless allows for transformation. Crisis, external change, shifts in allied fields, and strategic action can destabilize established positions and alter the settlement through which advantages were reproduced.

These traditions support a careful distinction between *resources* and *relational power*. Resources can contribute to power, but their efficacy depends on recognized rights, dependencies, alternatives, institutional location, and field-specific convertibility. Conversely, relational advantage may persist even when no single actor consciously designed it. A supplier occupying a bottleneck position, a platform controlling access to a user base, a credentialing organization defining entry standards, or a central bank possessing legally constituted authority may exercise very different kinds of power despite all being describable through asymmetric relations.

The normative implication should remain separate from the explanatory claim. Relational power is not inherently unjust, and relational dependence is not automatically domination. Some asymmetries may be temporary, functionally necessary, democratically authorized, or compensated by countervailing relations. Others can become extractive, exclusionary, or self-reinforcing. Chapter 2 therefore establishes analytical resources for identifying relational power without yet supplying GRE's normative theory of power, exploitation, or justice.

### 2.21.5 Dynamic and Multilevel Social Relations

The final foundation concerns dynamics and levels. Relational analysis becomes especially important when relations are changing, when actors participate in multiple structures simultaneously, and when processes at one level modify structures at another. Elias's figurational sociology is inherently dynamic: interdependencies, power balances, standards of conduct, personality structures, and state formation develop over long temporal sequences rather than remaining fixed while actors move within them (Elias 1978). This processual orientation resists the tendency to turn a snapshot of relations into a timeless structure.

Network sociology similarly provides tools for moving between levels. Breiger's person-group duality shows that membership relations can simultaneously generate

structures among persons and among groups (Breiger 1974). White, Boorman, and Breiger show how multiple ties can be aggregated into role and position structures (White et al. 1976). White's later theory makes emergence itself central by examining how identities and social formations develop through recurrent networked processes (White 2008). These approaches differ, but all challenge a simple division in which micro actors and macro structures belong to disconnected analytical worlds.

Field theory adds another multilevel vocabulary. Bourdieu connects embodied dispositions, practices, positions, fields, and wider distributions of capital without reducing one level mechanically to another (Bourdieu and Wacquant 1992). Fligstein and McAdam explicitly place strategic action fields inside broader systems of fields, allowing changes in states, markets, professions, movements, or neighboring organizational arenas to alter the stability of a focal field (Fligstein and McAdam 2012). A social order can therefore be locally stable while remaining dependent on relations extending beyond its apparent boundary.

This literature also warns against treating boundaries as self-evident. Network boundaries depend on which relations and actors are included. Field boundaries can be contested and historically variable. Organizational membership can connect actors across fields. Economic relations can cross legal jurisdictions and political boundaries. Multilevel analysis therefore requires explicit decisions about scale and boundary rather than assuming that "the market," "the organization," "the class," or "society" is naturally given as the correct unit.

The broad relational inheritance can now be stated without collapsing its components. Simmel provides forms of interaction; Elias figurations and changing interdependence; network sociology ties, positions, structural equivalence, and person-group dualities; Bourdieu fields, capital, habitus, and symbolic power; Emirbayer a programmatic defense of relational and transactional explanation; and Fligstein and McAdam a theory of strategic action fields embedded within wider field systems. These traditions converge on the inadequacy of explaining social life solely through isolated attributes, yet they diverge over ontology, mechanism, method, scale, and the role of culture and agency.

For later GR and GRE, this is an important but limited foundation. The literature makes it possible to ask how actors, capacities, positions, and opportunities depend on relational configurations; how one relation alters the effects of another; how structures persist while their participants change; and how local fields are affected by wider systems. GR can later formulate stronger questions concerning relations that generate other relations, changes in the rules of relation formation, and cross-level generative feedback. GRE can investigate how those processes organize production, exchange, valuation, power, and access. None of those later moves follows automatically from relational sociology or field theory. The contribution of the present section is prior: social actors and economic possibilities can be constituted and differentiated through dynamic relational positions whose explanatory significance cannot always be recovered from isolated properties alone.

## 2.22 Capability and Human Development Approaches

The preceding sections reconstructed traditions that place economic action within institutions, relations, positions, and social fields. Capability and human-development approaches shift the evaluative question in another direction. Their central concern is whether resources, incomes, rights, services, and institutional arrangements become effective opportunities for persons to live forms of life they have reason to value. The role of this section is to reconstruct the intellectual foundations of that shift. Its objective is not to present the capability approach as a completed theory of development or as an early version of GRE, but to clarify the distinctions through which resources, capabilities, functionings, freedom, agency, and institutional conditions became analytically separable. The discussion proceeds from resources and conversion factors to capabilities, achieved functionings, freedom and opportunity, and the institutional conditions under which capabilities are formed and sustained.

The literature contains several related but non-identical projects. Sen develops the capability approach as an evaluative framework concerned with substantive freedom and human diversity rather than a fixed comprehensive doctrine of the good (Sen 1985; Sen 1992; Sen 1999). Nussbaum develops a more specified philosophical version oriented toward central human capabilities, thresholds, dignity, and political principles (Nussbaum 2000). The human-development tradition associated with the United Nations Development Programme translates related concerns into a broad policy framework in which development concerns people's opportunities and choices rather than aggregate income alone (United Nations Development Programme 1990). Alkire and later capability scholarship examine how such a deliberately plural framework can be operationalized without reducing it to one scalar measure (Alkire 2002; Robeyns 2005). These lineages overlap substantially, but their differences over specification, valuation, measurement, and political justification should remain visible.

### 2.22.1 Resources and Conversion Factors

A foundational move in the capability literature is the distinction between the possession of resources and the effective opportunities resources make possible. In *Commodities and Capabilities*, Sen redirects welfare analysis from commodities or utility toward what a person is able to do or be with the means available to that person (Sen 1985). Two persons with the same commodity bundle can obtain different practical possibilities from it because bodies, environments, social norms, public services, family arrangements, and other circumstances affect how resources can be converted into valuable states and activities. Equality of resources can therefore coexist with substantial inequality in effective opportunity.

The distinction develops a problem already visible in Sen's earlier entitlement analysis. Access to food, income, or other goods does not depend simply on aggregate availability; it depends on the relations through which people can command resources (Sen 1981). The capability approach extends the evaluative question further. Even where a person possesses a resource, the resource's contribution to life depends on what that person can actually make of it. A bicycle can provide mobility for one person while being unusable by another because of bodily impairment, unsafe

infrastructure, prohibitive social norms, or an absence of accessible roads. The same nominal resource can therefore have heterogeneous consequences across persons and settings.

Later capability literature commonly organizes these differences through the language of *conversion factors*. Robeyns distinguishes personal, social, and environmental factors that mediate conversion from means into effective opportunities and achieved functionings (Robeyns 2005). Personal conversion factors include bodily condition, age, skills, and other individual characteristics. Social conversion factors include norms, discrimination, institutions, power relations, and public policies. Environmental conversion factors include geographical, infrastructural, ecological, and technological conditions. This classification is analytical rather than exhaustive. Its significance lies in preventing resource possession from being treated as if it were already a sufficient description of practical freedom.

This shift also separates the capability approach from a narrow interpretation of human capital. Education and health can increase productive capacities and earnings, but their significance need not be exhausted by their contribution to output. Sen's development framework treats education, health, political participation, and social opportunity as constitutive of substantive freedom as well as potentially instrumental to economic performance (Sen 1999). A person's literacy may increase productivity, but it can also enlarge communication, political participation, access to knowledge, self-direction, and the range of lives the person can realistically pursue.

The analytical implication is precise. Resources are important, but they are generally *means* whose significance depends on conversion conditions. Conversion factors are not themselves automatically capabilities; they help determine whether particular capabilities become available. This prevents three levels from being conflated: what a person possesses, the conditions under which those means can be used, and the effective opportunities that result. For later economic analysis, this is a major conceptual inheritance because distributions of nominal resources cannot by themselves describe distributions of effective economic possibility.

### 2.22.2 Capabilities

A *capability* concerns a person's genuine opportunity to achieve valuable beings and doings. Sen's language is deliberately oriented toward substantive freedom rather than a simple inventory of internal attributes (Sen 1992; Sen 1999). Capability therefore should not be reduced to skill, competence, talent, or human capital. A person may possess a skill without having the social permission, material support, legal standing, institutional access, or environmental conditions required to exercise it. Conversely, institutions can sometimes create an effective opportunity even where the relevant opportunity does not arise from an individually possessed skill.

The idea of a capability set makes the distinction especially clear. Evaluation can concern not only the life actually achieved but also the feasible combinations of functionings from which a person can choose (Sen 1985; Sen 1992). Two people may display the same observed functioning while possessing very different alternatives. A person who fasts despite having adequate food and a person who is involuntarily hungry can share a similar nutritional outcome while differing radically in freedom.



The capability perspective therefore gives evaluative significance to the opportunity set behind an observed achievement.

Sen intentionally leaves the capability approach incomplete in several respects. The framework identifies an evaluative space but does not itself provide one universally fixed list of capabilities, one weighting system, or one institutional blueprint for every application. Public reasoning, context, purpose, and explicit valuation remain necessary (Sen 1992; Sen 1999). Alkire's work on operationalization takes this incompleteness seriously: practical use requires identifying relevant capabilities and making value judgments, but operationalization need not erase plurality by forcing every dimension into a comprehensive doctrine or single metric (Alkire 2002).

Nussbaum develops a more specified version of the capabilities approach. Her account identifies central human capabilities and argues that political principles should secure threshold levels of these capabilities for persons (Nussbaum 2000). This introduces a stronger substantive specification than Sen usually accepts. The difference is theoretically important. Sen's framework retains greater openness about capability selection and weighting, whereas Nussbaum offers a philosophical account intended to support constitutional and political guarantees. Both approaches treat utility and resource possession as insufficient, but they differ over how much substantive content the theory itself should specify in advance.

The capability concept consequently occupies an intermediate analytical position. It is richer than formal entitlement because an officially recognized right may lack effective conditions of exercise. It is also different from achievement because a capability can exist even when a person chooses not to realize it. And it is broader than individual skill because capabilities depend on relations among persons, institutions, resources, infrastructures, norms, and environments. The capability approach thereby relocates evaluation from possession alone toward effective possibility.

### 2.22.3 Functionings

*Functionings* refer to achieved beings and doings: being adequately nourished, being educated, participating in social life, moving safely, caring for others, working under certain conditions, or taking part in collective decisions are examples of the kinds of achievements capability analysis can examine (Sen 1985; Sen 1992). Functionings therefore describe realized aspects of life rather than the full range of alternatives available to a person. The distinction between capability and functioning separates effective opportunity from achievement.

This distinction creates both normative and empirical questions. In many contexts, achieved functionings matter directly. Severe malnutrition, avoidable mortality, illiteracy, or exclusion cannot be dismissed merely because a formal opportunity is said to exist. At the same time, exclusive attention to observed functionings can conceal differences in freedom. Similar achievements can arise through choice, constraint, coercion, necessity, or the absence of alternatives. Capability analysis therefore asks what opportunities lay behind the observed state rather than treating achievement alone as a complete measure of advantage.

The capability-functioning distinction also complicates measurement. Functionings are often easier to observe than opportunity sets. Capabilities can involve coun-



terfactual alternatives that were available but not chosen, making empirical identification more demanding (Robeyns 2005). Practical applications therefore frequently use combinations of direct functioning indicators, information about constraints and access, and institutional evidence as imperfect proxies for substantive opportunity. Alkire's work makes this operational problem explicit: a multidimensional evaluative framework requires judgments about relevant dimensions, informational adequacy, participation, and the practical purpose of the assessment (Alkire 2002).

The literature on adaptive preferences supplies an additional reason not to identify welfare with reported satisfaction or revealed preference. Long-standing deprivation can shape aspirations, expectations, and the interpretation of what is feasible or deserved. Nussbaum's discussion of women's options makes adaptive preference a central challenge for policy evaluation: acquiescence to constrained circumstances cannot automatically be treated as evidence that those circumstances provide adequate opportunity (Nussbaum 2000). Sen's broader capability framework likewise resists using utility alone as the informational basis for judging deprivation because subjective satisfaction can adapt to persistent disadvantage (Sen 1992).

This does not make individual preferences irrelevant. It changes their analytical status. Preferences, choices, and reported satisfaction become evidence situated within a wider account of opportunity, social formation, and agency. A capability analysis can therefore examine both whether a valued functioning is achieved and whether the person had meaningful alternatives. The resulting evaluative space is multidimensional: achievement, opportunity, agency, and the conditions under which preferences form can each matter without being reduced to one another.

#### 2.22.4 Freedom and Opportunity

Freedom is central to Sen's development approach, but the relevant freedom is more demanding than formal permission or the mere existence of multiple nominal options. In *Inequality Reexamined*, Sen distinguishes achievement from freedom and separates aspects of well-being from broader agency concerns (Sen 1992). *Development as Freedom* subsequently treats expansion of substantive freedoms as both a constitutive component and an instrumental condition of development (Sen 1999). Political liberties, economic facilities, social opportunities, transparency guarantees, and protective security can interact in expanding or constraining what people are effectively able to do.

The capability perspective therefore separates *formal choice* from *effective opportunity*. A legal right to education has limited capability significance where schools are inaccessible, discriminatory, unsafe, or unaffordable. Formal permission to work may coexist with exclusion from transportation, childcare, documentation, networks, or the social recognition needed to obtain employment. Conversely, institutional supports can transform the same nominal right into a substantially different opportunity. Freedom consequently depends on the organization of enabling conditions, not only on the absence of direct prohibition.

Sen also distinguishes well-being from agency. A person can pursue objectives concerning other persons, public goods, political causes, communities, or principles even where those commitments do not maximize that person's own welfare (Sen 1992; Sen

1999). Agency widens the evaluative subject beyond passive receipt of benefits. People can participate in shaping institutions, articulating priorities, contesting deprivation, and deciding which opportunities matter. This is one reason development cannot be represented adequately as delivery of resources to otherwise passive recipients.

The human-development approach institutionalized a closely related shift in policy language. The first *Human Development Report* defines development in terms of enlarging people's choices and explicitly rejects GNP, income, commodity production, and capital accumulation as sufficient measures of human development (United Nations Development Programme 1990). Health, education, material resources, political freedom, rights, and self-respect enter a wider picture of human possibility. The human-development approach is not identical with Sen's capability framework, but it shares the movement from aggregate economic means toward the lives and opportunities those means help make possible.

Freedom in this lineage is therefore both evaluative and institutional. It concerns the range of lives available to persons, the conditions under which choices can be made, and the agency through which persons can participate in determining social priorities. A larger count of options does not necessarily imply greater substantive freedom when options are unusable, coercively structured, or disconnected from what a person has reason to value. The capability literature consequently turns attention from abstract choice sets toward the quality and accessibility of opportunity.

### 2.22.5 Institutional Conditions of Capability Formation

The phrase *institutional conditions of capability formation* is used here as an organizing label for a problem distributed across the capability and human-development literatures. It does not designate a single canonical theory shared by Sen, Nussbaum, Alkire, or the UNDP tradition. The common problem is that effective opportunities depend on social arrangements whose formation and maintenance cannot be inferred from a person's resource endowment alone. Schools, health systems, legal rights, public infrastructures, care arrangements, labor institutions, political freedoms, family relations, gender norms, public security, and environmental conditions can each alter the conversion of means into capabilities.

Drèze and Sen's analysis of development and participation gives public action a central role in this process. Their account connects the removal of deprivation and expansion of effective freedom to complementary economic, social, and political institutions, including education, health care, social security, gender equality, civil rights, democratic participation, and public accountability (Drèze and Sen 2002). Capability expansion is therefore not simply a matter of raising private purchasing power. Public goods, institutional access, social norms, political voice, and collective provision can alter the effective opportunities associated with a given income.

Nussbaum's work similarly makes institutional and social conditions indispensable. Her treatment of gender justice shows how family organization, religion, law, education, bodily security, and socially adaptive expectations can affect whether central capabilities are genuinely available (Nussbaum 2000). The capability perspective therefore enables analysis of deprivation that would remain invisible if evaluation

stopped at formal rights or household resources. A person can belong to a resource-owning household and nevertheless lack effective control over resources, mobility, bodily integrity, political participation, or access to education.

Human-development practice develops the same insight at a policy scale. The 1990 Human Development Report treats income as one means among others and connects human development to health, knowledge, resources for a decent standard of living, political freedom, rights, and self-respect (United Nations Development Programme 1990). Alkire's work then shows why operationalization must remain attentive to multidimensionality and explicit valuation rather than assuming that one observable indicator represents all relevant freedoms (Alkire 2002). Capability formation is thus simultaneously material, social, institutional, and evaluative.

These traditions provide an important foundation for GRE while leaving substantial questions open. They establish that economic advantage cannot be inferred directly from resources, income, or formal rights; that conversion conditions mediate effective opportunity; that capabilities differ from achieved functionings; that agency and substantive freedom matter; and that institutions participate in producing or restricting the opportunity sets available to persons. Later GRE can build on this inheritance by examining how capabilities themselves are generated, maintained, eroded, converted, and transmitted through changing relations and institutions. It can also ask how one person's capability expansion affects the capabilities of others, how collective capabilities become possible, and how the institutions that convert resources into opportunities are themselves reproduced or transformed. Those stronger generative-relational questions are deferred. The present section establishes the theoretical resources that make them intelligible.

## 2.23 Care, Feminist, and Social Reproduction Economics

The preceding sections reconstructed capability approaches that distinguish resources from the substantive opportunities people can actually exercise. Care, feminist, and social-reproduction traditions deepen a related problem from another direction: the economic conditions of life include activities, dependencies, institutions, and relations that are only partially visible in market exchange, wage statistics, or conventional measures of output. The role of this section is to reconstruct the theoretical lineages through which care, reproductive labor, dependency, unpaid activity, and social reproduction became economic objects in their own right. Its objective is not to combine these traditions into a single feminist theory of the economy, and still less to present them as completed forms of GRE. The discussion instead distinguishes care ethics, feminist economics of paid and unpaid care, and Marxian-feminist theories of social reproduction before examining the conceptual resources they provide for later relational analysis.

These literatures overlap while asking different questions. Care ethics investigates the moral and political significance of caring relations, dependency, responsibility, and attentiveness (Tronto 1993; Held 2006; Kittay 1999). Feminist economics asks how conventional economic boundaries, models, labor categories, and accounting systems treat household production, care work, gendered constraints, and well-being

(Folbre 1994; England 2005; Waring 1988; Power 2004). Social-reproduction theory asks how labor-power, persons, households, communities, and the social conditions required for production are reproduced across time (Benería 1979; Vogel 1983; Fraser 2014). Their objects can intersect, but care is not identical with unpaid labor, unpaid labor is not identical with social reproduction, and social reproduction is not exhausted by activity within households.

### 2.23.1 Care Relations

Care entered modern feminist theory partly through a critique of moral and political theories organized around abstract, independent, and interchangeable agents. The resulting literature is internally diverse. Tronto's *Moral Boundaries* treats care as a central activity of human life while rejecting its confinement to a supposedly private women's morality (Tronto 1993). Care is politically organized: societies distribute responsibilities for attending to needs, performing care, receiving care, and avoiding care work unequally. Gender, class, race, citizenship, and institutional position can therefore affect not only who receives adequate care but also whose time and labor become available to provide it.

Held similarly develops an ethics centered on caring relations rather than only on the virtues or choices of isolated individuals (Held 2006). Her approach does not make care the sole moral value. It asks how care, trust, mutual consideration, justice, equality, and rights can be related without assuming that impartial rules exhaust moral life. This relational emphasis matters economically because many activities conventionally modeled as services or household tasks are also interactions whose quality depends on attention, responsiveness, continuity, trust, and knowledge of particular persons. A unit of care cannot always be described adequately by its duration or monetary price alone.

Kittay makes dependency especially central. *Love's Labor* argues that dependency is not an exceptional deviation from an otherwise autonomous human condition; infancy, illness, disability, aging, and other forms of dependence are recurring features of human life (Kittay 1999). The person who depends on care is only one side of the institutional problem. The caregiver or "dependency worker" may also require resources, time, income, recognition, and support. A social order that acknowledges the needs of dependents while privatizing the costs borne by caregivers can therefore reproduce inequality through the organization of care itself.

These arguments make care a relation without implying that every care relation is benign. Dependence can coexist with affection, obligation, coercion, hierarchy, exhaustion, exploitation, professional responsibility, or reciprocal commitment. Tronto's political treatment of care is particularly important here because it makes the allocation of caring responsibilities a question of power as well as morality (Tronto 1993). Care can be indispensable while the institutional arrangement through which it is provided remains unequal. The analytical object is consequently broader than the caregiver's motive: it includes the distribution of needs, responsibilities, resources, authority, and possibilities of refusal.

Care relations also complicate the boundary between market and nonmarket action. England's survey of care-work theories identifies several distinct explanations

for the low valuation or difficult organization of paid care, including devaluation associated with feminized work, public-good characteristics, the leverage employers can obtain from workers' intrinsic commitments, concerns over commodifying emotion, and arguments against treating love and money as mutually exclusive (England 2005). The coexistence of payment and care therefore cannot be interpreted through a simple opposition between altruistic relations and market relations. Paid care can remain relational and morally significant; unpaid care can be coercively allocated or unequally supported.

For economic theory, the foundational contribution of these traditions is to identify care as an activity whose outputs and conditions are partly relational. The quality of care can depend on continuity, responsiveness, trust, knowledge, time, and institutional support, while the burdens and benefits of care are distributed across persons and organizations. This does not make care analytically ineffable or exempt from economic inquiry. It makes the relevant economic object richer than a commodity quantity considered independently of the relation through which the activity is performed.

### 2.23.2 Reproductive Labor

A second lineage concerns the labor through which persons and laboring capacities are maintained and renewed. Benería's analysis of reproduction, production, and the sexual division of labor was an early contribution to feminist political economy precisely because it resisted treating reproductive activity as an external background to production (Benería 1979). Domestic labor, childrearing, food preparation, household maintenance, and related activities can affect the reproduction of the labor force and the organization of paid employment even when they do not themselves appear as wage labor.

Marxian-feminist social-reproduction theory develops this problem more systematically. Vogel's reconstruction centers the reproduction of labor-power and asks how generational replacement, daily maintenance, domestic labor, and the gendered organization of reproduction relate to capitalist production (Vogel 1983). This differs from an account in which capitalism and patriarchy simply operate as two independent systems whose effects are subsequently added together. The analytical task is to explain how the reproduction of labor-power is organized within a wider social formation and why that organization can be gendered without assuming that every reproductive activity takes place outside markets or under one invariant household form.

The term *reproductive labor* consequently covers more than biological reproduction. It can include work required to sustain persons, households, and capacities over time: preparing food, cleaning, caring for children or adults, maintaining social relations, providing emotional support, and enabling workers to return to paid activity. Yet the category should not be stretched without limit. Himmelweit's discussion of the "discovery" of unpaid work warns that extending a concept of work modeled on commodity-producing wage labor to every domestic activity can itself obscure important differences among labor, care, relationship, obligation, and activity (Himmelweit 1995). Recognition of unpaid activity as economically consequential



need not require every form of care or relational life to be redescribed exhaustively in the image of wage labor.

This caution helps distinguish three propositions. First, activities outside paid employment can be necessary to the reproduction of persons and productive capacities. Second, their exclusion from wage statistics does not eliminate their economic effects. Third, conceptual recognition as economically consequential does not mean that every such activity is best understood solely through the category of labor. Feminist economics has repeatedly worked across this tension: making invisible work visible without assuming that visibility requires translating all human activity into the categories through which markets already recognize work.

Folbre's analysis of the costs of social reproduction places this issue within structures of constraint (Folbre 1994). Decisions about children, care, household labor, and employment are made by persons, but the choices available to them depend on gendered expectations, family arrangements, public policy, labor markets, income, and other institutional conditions. The unequal distribution of reproductive costs therefore cannot be explained adequately either by individual preference alone or by a homogeneous household assumed to maximize one shared objective. Household decisions are embedded in bargaining positions and institutional rules that affect who can shift costs onto whom.

The reproductive-labor tradition therefore widens the temporal unit of economic analysis. Production at one moment depends on capacities whose maintenance occurred previously and whose future renewal cannot be taken for granted. Workers arrive at workplaces with bodies, skills, health, language, habits, social identities, and obligations that were not produced entirely within the firm. Children who require care today can become workers, citizens, caregivers, or dependents in later periods. Reproductive labor consequently links present production to intergenerational and life-course processes whose costs and benefits may fall on different actors at different times.

### 2.23.3 Dependency and Interdependence

The care and social-reproduction literatures also challenge theories that treat independence as the normal baseline from which dependency appears as an exceptional condition. Kittay's analysis makes dependency structurally important to equality because persons pass through periods in which they cannot secure their own basic needs and because those who care for them can themselves become economically or politically vulnerable (Kittay 1999). Fineman develops a related critique of the autonomous and self-sufficient subject, arguing that dependency and caretaking responsibilities are pervasive features of social life rather than private anomalies to be absorbed by families without public consequence (Fineman 2004).

Dependency and interdependence should nevertheless remain distinct. Dependency can describe an asymmetrical condition in which one person's well-being depends heavily on another person's care or on an institution. Interdependence refers more broadly to mutual or system-level dependence among persons, organizations, and infrastructures. A newborn infant and an adult caregiver are interdependent in a broad social sense, but their immediate capacities and responsibilities are not sym-

metrical. Treating all dependency as mutual interdependence can therefore conceal unequal vulnerability; treating all persons as simply dependent can obscure meaningful differences in autonomy and responsibility.

Feminist economics adds a distributional dimension to this problem. Folbre argues that societies face a collective problem in allocating the costs of care for children, older persons, and others whose needs cannot be met through individual self-provision alone (Folbre 1994; Folbre 2001). Caring labor can generate benefits extending beyond the immediate recipient. The education, health, socialization, and maintenance of persons can benefit employers, communities, future citizens, and public institutions that did not bear corresponding costs. Where responsibilities remain concentrated within households or on particular groups, the production of socially valuable capacities can coexist with private economic penalties for those who provide care.

This helps explain why dependence is not only an interpersonal phenomenon. It is institutionally mediated. Public education, health systems, pensions, childcare, disability support, labor law, immigration rules, household income, transport, housing, and working-time arrangements can redistribute both the need for direct care and the burdens of providing it. Market income can purchase some forms of care, but access to money does not abolish dependence; it changes the relations through which care is organized. Similarly, public provision can socialize some costs while leaving other burdens within families or communities.

The dependency literature therefore supplies a corrective to both atomistic individualism and romanticized relationality. Persons are not independent units that only later choose whether to enter caring relations, but neither does dependence imply that every relation is constitutive in the same way or normatively desirable. Economic analysis must be able to represent vulnerability, unequal need, asymmetric responsibility, and institutional mediation. The important inheritance for later work is the recognition that capacities commonly attributed to individuals can depend on networks of care and support whose organization is economically consequential.

#### 2.23.4 Unpriced and Underrecognized Value

A fourth line of feminist-economic inquiry concerns valuation and measurement. Waring's critique of national accounting made visible a basic asymmetry: activities can be indispensable to the reproduction of households and economies while remaining absent, marginal, or differently treated within official measures of economic production (Waring 1988). The absence of an activity from a monetary aggregate does not establish that it has no value. It establishes that the accounting boundary and valuation convention do not assign it the same status as activities counted within that aggregate.

This distinction is important because *unpriced*, *unpaid*, *unmeasured*, and *undervalued* are different properties. Unpaid household care has no wage transaction, but paid care can still be underpaid relative to other occupations. An activity can be measured in time-use data without receiving a market price. A service can carry a price while dimensions of quality, emotional labor, continuity, or relational responsibility remain poorly represented by that price. Conversely, placing an imputed monetary

value on unpaid work can improve visibility without resolving every question about its meaning, distribution, or institutional organization.

England's review is useful precisely because it identifies several mechanisms through which care can be economically undervalued (England 2005). A devaluation explanation emphasizes the lower rewards assigned to work culturally associated with women or racialized groups. A public-good account emphasizes benefits to others that individual purchasers may not fully internalize. A "prisoner of love" mechanism concerns the possibility that strong intrinsic commitments weaken caregivers' bargaining position. Other approaches focus on the tensions or compatibilities between monetary exchange and intimate or emotional relations. Low wages in care occupations therefore need not have one universal cause.

Himmelweit adds a conceptual caution to the valuation project (Himmelweit 1995). Expanding the category of work can make domestic activity visible, but the concepts used for visibility can themselves reshape what is being described. If every valuable activity is recognized only by assimilating it to wage labor, economic analysis may reproduce the very hierarchy it seeks to overcome by making market-like work the model of intelligibility. Recognition can consequently require multiple descriptive and evaluative languages rather than a single monetary translation.

Power's formulation of *social provisioning* provides one influential feminist-economic response. It treats paid and unpaid care as fundamental economic activities and combines concern for well-being with analysis of political-economic processes, power, ethical values, and intersecting differences such as class and race (Power 2004). This approach does not imply that all values are incommensurable or that prices are analytically irrelevant. It changes the starting boundary of the economy: provisioning human life becomes an economic object even where its organization crosses households, markets, states, communities, and ecological conditions.

The valuation problem therefore has at least two dimensions. One concerns *recognition*: whether an activity enters economic representation at all. The other concerns *valuation*: what measure, standard, or institutional process is used once the activity has been recognized. These dimensions can diverge. Greater statistical visibility may coexist with persistent inequality in pay, time burdens, authority, or access to support. Conversely, activities can be socially honored while those performing them remain economically dependent. Feminist economics thus turns valuation into a question about boundaries, metrics, bargaining power, and institutional recognition rather than only a question about assigning prices.

### 2.23.5 Relational Conditions of Social Reproduction

The phrase *relational conditions of social reproduction* is used here as an organizing label for a problem distributed across care ethics, feminist economics, and social-reproduction theory. It is not a canonical category shared by Tronto, Folbre, Vogel, Fraser, or Power. The common problem is that the reproduction of persons, capacities, households, labor-power, and institutions depends on relations whose maintenance is itself historically organized. Care relations, gender relations, employment relations, kinship, public provision, migration regimes, housing arrangements, edu-

cational institutions, and fiscal systems can all alter who performs reproductive activity, under what conditions, and with what resources.

Vogel's social-reproduction analysis makes the reproduction of labor-power central to Marxist-feminist theory (Vogel 1983). Fraser extends the problem by describing capitalist accumulation as dependent on background conditions that include social reproduction, public power, and ecological processes even while accumulation can destabilize those conditions (Fraser 2014). These arguments differ in scope, but both resist an image of production as a self-contained sphere capable of reproducing all of its own conditions internally. The apparent autonomy of the formal economy can partly depend on analytical and institutional boundaries that place some necessary activities elsewhere.

Folbre's structures-of-constraint approach adds another dimension. The organization of reproduction is affected by relations among gender, age, family, markets, states, and other institutions that shape individual choice without eliminating agency (Folbre 1994). Power's social-provisioning approach similarly treats economic activity as a set of interdependent social processes rather than as exchange among already self-sufficient agents (Power 2004). These perspectives make it possible to ask not only how much care is supplied but how the relations through which care is supplied affect future capacities, bargaining positions, inequalities, and institutional possibilities.

The temporal structure is especially important. Care provided in one period can preserve health, transmit knowledge, sustain attachment, support recovery, or enable later participation in education and employment. Conversely, underprovision of care can accumulate into later constraints. Yet the capacity to provide care is also reproduced or depleted through working time, income, housing, public services, emotional resources, migration status, and the availability of other caregivers. Social reproduction therefore concerns both the reproduction of persons and the reproduction of the conditions under which reproductive activity can continue.

These traditions also caution against assuming that successful reproduction is normatively sufficient. An unequal household, exploitative labor regime, or exclusionary welfare system can reproduce itself effectively. Reproduction describes persistence or renewal; it does not by itself establish justice, flourishing, or legitimacy. Likewise, a crisis of reproduction can impose severe harms while also opening possibilities for institutional change. Analysis must therefore distinguish the capacity of a social order to reproduce itself from the distribution of burdens, capabilities, recognition, and power within that order.

For later GRE, the inherited theoretical resources are substantial but incomplete. Care ethics establishes the moral and political significance of dependency and caring relations. Feminist economics makes unpaid work, care, provisioning, measurement boundaries, and gendered constraints economically visible. Social-reproduction theory links the maintenance of persons and laboring capacities to the reproduction of wider social and economic orders. Later generative-relational analysis can build on these lineages by examining how care relations generate or erode capabilities, how reproductive burdens alter subsequent bargaining positions and economic trajectories, how institutions convert private care into public capacities, and how the reproduction of one relation changes the conditions under which other relations can persist or transform. Those stronger claims are deferred. The present section establishes the

lineages that make such questions intellectually and economically intelligible.

## 2.24 Commons, Cooperative, and Solidarity Economic Traditions

The preceding sections reconstructed institutional, relational, capability, care, and social-reproduction approaches that widened the economic object beyond exchange among already constituted individuals. The present section turns to another cluster of traditions in which resources, production, infrastructure, and livelihood are organized through forms of shared access, collective rule-making, democratic ownership, reciprocity, and solidarity. Its role is genealogical. Its objective is to distinguish common-pool-resource analysis, collective-governance theory, cooperative production, shared-infrastructure approaches, and solidarity-economic traditions before identifying the conceptual resources they leave available for later GR and GRE. These traditions frequently intersect in practice, but they address different analytical problems and should not be collapsed into a single theory of “the commons.”

Several distinctions are therefore necessary at the outset. A *common-pool resource* describes a class of resource problem characterized by costly exclusion and subtractive appropriation; it does not by itself specify a property regime. A *commons* ordinarily involves a resource together with a community, rules, practices, or institutions through which access and use are organized. A *cooperative* is an organizational form whose members jointly own and democratically control an enterprise under specified principles (International Cooperative Alliance 1995). A *shared infrastructure* is a resource or system that enables multiple downstream activities and can be governed through public, private, commons-based, or hybrid arrangements. *Solidarity economy* refers to a wider family of associational practices and movements in which economic activity is organized around collective or social purposes, democratic participation, reciprocity, mutual aid, and related principles (Laville 2010). The overlap among these categories is economically important precisely because their meanings are not identical.

### 2.24.1 Common-Pool Resources

Modern commons scholarship developed partly in response to a powerful diagnosis of collective-resource failure. Hardin’s “tragedy of the commons” presented a stylized setting in which individually rational appropriation from a shared pasture produces collective depletion when users receive private gains while distributing much of the cost of overuse across the group (Hardin 1968). The argument became highly influential because it made a structural problem visible: when access is difficult to exclude and withdrawals reduce what remains available, individually advantageous action can be incompatible with sustained collective use.

The subsequent common-pool-resource literature altered the meaning of this problem. Ostrom’s empirical work showed that the relevant institutional possibilities cannot be represented adequately by a simple choice between privatization and centralized state control (Ostrom 1990). Users of fisheries, irrigation systems, forests, graz-



ing lands, groundwater basins, and other resources have in some settings developed durable arrangements for defining access, monitoring use, sanctioning violations, resolving conflicts, and modifying rules. These cases do not refute the possibility of tragedy. They establish that resource characteristics do not determine one inevitable governance outcome.

This point requires a distinction between *resource type* and *property regime*. A common-pool resource can be managed under private property, public authority, communal property, open access, or combinations of these. Open access is therefore not synonymous with commons governance. A resource can be physically or legally shared while lacking institutions capable of limiting appropriation, financing maintenance, or resolving disputes. Conversely, collectively governed access can involve defined membership, exclusion of outsiders, graduated rights, obligations to contribute, or differentiated forms of use. The institutional question concerns how access, appropriation, provision, monitoring, sanctioning, and rule revision are organized under particular material and social conditions.

Ostrom's comparative analysis is important because it treats institutional performance as conditional rather than deriving a universal blueprint from successful cases. Long-enduring arrangements often exhibit boundaries, locally adapted rules, monitoring, graduated sanctions, conflict-resolution mechanisms, and opportunities for users to participate in rule modification, yet the configuration and importance of these features vary by setting (Ostrom 1990). Scale, mobility of the resource, observability, ecological dynamics, heterogeneity among users, external authorities, and histories of cooperation can all affect what forms of collective governance are feasible.

Common-pool-resource analysis consequently shifts economic attention from the abstract proposition that scarcity produces rivalry to the institutional organization of rivalry. Scarcity can be mediated through quotas, rotational access, territorial rights, seasonal restrictions, contribution requirements, community monitoring, pricing, or other arrangements. Different rules distribute not only quantities of a resource but also monitoring burdens, decision rights, uncertainty, risk, and future access. The economic object is therefore simultaneously material and institutional.

For later GRE, this literature provides a foundation for asking how shared resources and institutional capacities co-develop over time. Chapter 2 should stop short of converting that foundation into a general GR theory. The established lesson is narrower: collective-resource problems are generated through the interaction of resource characteristics, user relations, rules, information, and enforcement, and the institutional form through which a shared resource is governed is itself an explanatory variable.

### 2.24.2 Collective Governance

The commons literature also contributed to a broader theory of collective governance. Ostrom's institutional analysis rejects the assumption that effective coordination requires one sovereign center capable of specifying and enforcing all relevant rules. Her later work on polycentric governance emphasizes systems containing multiple formally independent centers of decision-making whose jurisdictions, functions, and

interactions can overlap (Ostrom 2010). Such arrangements can include user associations, municipalities, courts, regulatory agencies, firms, customary authorities, and higher-level governments rather than one homogeneous category of “community governance.”

Polycentricity matters because many collective-action problems operate across scales. A local irrigation association may be able to monitor water withdrawals more effectively than a distant ministry while still depending on public courts, watershed regulation, infrastructure finance, or regional conflict resolution. Local knowledge can improve rule fit without guaranteeing fairness or ecological adequacy. Central authorities can supply resources or legal recognition while also imposing rules poorly adapted to local conditions. The relevant question becomes how different centers of authority are related, which functions they perform, how information travels among them, and how conflict among jurisdictions is managed.

Ostrom’s Institutional Analysis and Development framework gives this problem a more general form. Rules-in-use, material conditions, community attributes, positions, actions, information, control, and payoffs can be analyzed as components of action situations rather than treated as one undifferentiated institutional context (Ostrom 2005). This is useful for Chapter 2 because it establishes that collective governance has an internal architecture. Participation in a governing arrangement can involve different rights to access, withdraw, manage, exclude, monitor, sanction, authorize, or revise rules. A collective institution is therefore not reducible to the number of people nominally included in it.

The literature also cautions against romanticizing collective governance. Communities can reproduce hierarchy, exclusion, gendered authority, ethnic boundaries, unequal bargaining power, or control by locally dominant actors. Monitoring can become surveillance; strong boundaries can protect a resource while excluding groups whose livelihoods depend on it; locally legitimate practices can conflict with wider legal or ecological obligations. Collective governance denotes a mode of institutional organization, not an automatic certificate of justice.

A second caution concerns the relation between autonomy and external support. Durable commons can require recognition by public authorities, legally enforceable boundaries, scientific information, infrastructure investment, or access to wider conflict-resolution systems. The International Cooperative Alliance’s principle of autonomy and independence similarly coexists with cooperation among cooperatives and concern for community rather than implying organizational isolation (International Cooperative Alliance 1995; International Cooperative Alliance 2017). Self-governance can therefore be institutionally nested.

The foundational contribution of collective-governance theory is to make rule-making capacity itself an economic resource. Participants may possess a shared asset yet lack institutions through which they can revise rules, coordinate investment, resolve disputes, or respond to ecological change. Conversely, governance capacity can allow a group to adapt the relation between resource use and resource renewal. Later GRE can build on this distinction when examining how governance capabilities are generated, distributed, and transformed, but the present section establishes only the inherited institutional vocabulary.

### 2.24.3 Cooperative Production

Cooperative traditions approach collective economic organization from a different direction. The modern cooperative movement is commonly associated with the Rochdale Pioneers of 1844, whose organization became an important prototype for later cooperative principles, while other cooperative and mutual forms developed through distinct national and sectoral histories. The contemporary International Cooperative Alliance defines a cooperative as a voluntary association formed to meet common economic, social, and cultural needs through a jointly owned and democratically controlled enterprise (International Cooperative Alliance 1995). This definition encompasses consumer, worker, producer, agricultural, housing, financial, and other cooperatives rather than one invariant firm type.

The cooperative idea also has a significant place within nineteenth-century political economy. Mill treated cooperative associations as a possible transformation of the relation between labor and enterprise. In his discussion of the future of the laboring classes, he emphasized the possibility that workers participating in the benefits and governance of production could alter incentives, independence, class relations, and the social meaning of work (Mill 1848). Mill's account is normative and developmental as well as economic; it should not be read as a modern formal theory of the labor-managed firm.

Twentieth-century economic theory subsequently examined worker-managed firms through more explicit behavioral assumptions. Ward's model of the labor-managed firm showed that changing the objective and decision rights attributed to an enterprise changes predicted responses to prices, labor, and output relative to the conventional profit-maximizing firm (Ward 1958). Vanek developed a broader theory of labor-managed market economies concerned with enterprise equilibrium, income sharing, investment, decentralized decision-making, and institutional form (Vanek 1970). These contributions are important because they demonstrate formally that the theory of the firm depends on assumptions about who controls the organization, which returns they receive, and what objective the enterprise is modeled as pursuing.

The formal literature should nevertheless be separated from the institutional diversity of actual cooperatives. A worker cooperative governed by worker-members differs from a consumer cooperative, a producer cooperative, a mutual financial institution, or a multi-stakeholder cooperative. Democratic member control can coexist with delegated management, professional expertise, wage differentials, external borrowing, contractual obligations, and competition in conventional markets. Joint ownership does not eliminate governance problems; it changes the distribution of residual claims, decision rights, membership obligations, and accountability through which those problems are addressed.

The ICA principles further indicate that cooperative organization is not defined solely by ownership shares. Voluntary and open membership, democratic member control, member economic participation, autonomy, education, cooperation among cooperatives, and concern for community form a normative-institutional identity whose application has changed historically and remains subject to interpretation (International Cooperative Alliance 1995; International Cooperative Alliance 2017). Co-

operative production thus combines an enterprise form with a governance tradition. Its economic significance can involve incentive alignment, distribution of surplus, control over investment, employment security, knowledge sharing, local anchoring, or bargaining power, but the presence and strength of these effects are empirical questions rather than consequences of the label alone.

For later GRE, cooperative traditions supply a particularly useful distinction between participation in production and participation in the governance of production. They also make visible the possibility that ownership, control, surplus allocation, and membership can be organized relationally in ways that differ from investor-owned firms. The section does not treat cooperative organization as intrinsically superior or as a completed form of generative return. It establishes a historical and theoretical lineage in which productive organization itself becomes an object of democratic and institutional design.

#### 2.24.4 Shared Infrastructures

Commons reasoning has also expanded beyond natural resources. Shared infrastructures create a different analytical problem because their value often lies in enabling heterogeneous downstream activities rather than in allocating a fixed stock among competing appropriators. Frischmann develops a demand-side theory of infrastructure in which roads, communication networks, environmental resources, basic research, and other infrastructural resources can generate social value by serving as inputs into a wide range of productive and social activities (Frischmann 2012). Decisions about access can therefore affect forms of value that are difficult to infer from the immediate willingness to pay of a single user.

The knowledge-commons literature further demonstrates why natural-resource analogies require adjustment. Hess and Ostrom analyze knowledge as a shared resource subject to questions of access, preservation, intellectual property, enclosure, collective action, and institutional design (Hess and Ostrom 2007). Knowledge differs materially from a fishery or grazing field because one person's use of an idea does not ordinarily subtract the same idea from another person's use. Scarcity can instead arise through access restrictions, attention, preservation costs, congestion of supporting systems, quality control, curation, or the resources required to produce and maintain knowledge.

Digital production provides another extension. Benkler's analysis of commons-based peer production uses free and open-source software and related projects to show how distributed contributors can organize significant productive activity through mechanisms that are not reducible to market prices or managerial command (Benkler 2002). The argument depends on conditions such as modularity of tasks, heterogeneity of motivations and capacities, low-cost communication, and mechanisms for integrating distributed contributions. Peer production is therefore a specific coordination form, not a general synonym for voluntary cooperation.

These literatures make the category of *shared infrastructure* analytically useful because access and production can be separated. A road, protocol, codebase, research repository, database, library, standard, or communication network may be used by many downstream actors whose activities differ substantially. The infrastructure can

be publicly owned, privately owned but regulated for access, cooperatively owned, openly licensed, or governed through hybrid arrangements. Shared use is therefore a functional relation between a resource and multiple productive activities; it does not specify ownership or governance by itself.

The distinction between resource creation and resource use is equally important. Open access to a knowledge resource may increase downstream experimentation while leaving unresolved who finances maintenance, verification, moderation, preservation, or technical infrastructure. A peer-production community can create a widely shared resource while still depending on paid labor, firms, foundations, public research institutions, or physical infrastructures situated elsewhere. Commons-based access does not remove the problem of reproducing the conditions under which the shared resource remains usable.

For GRE, the intellectual inheritance is substantial. Shared infrastructures show that value can be generated downstream by enabling activities whose identities and uses are not fully known in advance. Knowledge commons and peer production show that coordination can sometimes proceed through open contribution, shared standards, reputation, community governance, and distributed integration. Later generative-relational analysis can investigate how infrastructures enlarge or restrict future relation formation and how the benefits generated through shared foundations are captured, returned, or dissipated. Those are later claims. The present lineage establishes that infrastructure and commons governance cannot be reduced to ordinary commodity exchange.

### 2.24.5 Reciprocity and Solidarity

Commons and cooperative traditions also intersect with older theories of reciprocity and newer traditions of social and solidarity economy. Mauss's analysis of the gift is foundational because it treats exchange as embedded in obligations to give, receive, and reciprocate rather than as an isolated transfer between utility-maximizing strangers (Mauss 1990). Gift relations can carry legal, moral, religious, political, and status meanings at the same time. Reciprocity in this lineage is therefore not equivalent to immediate equivalence of value or simultaneous bilateral exchange.

Polanyi gives reciprocity a different theoretical location. His substantive account treats the economy as an instituted process and distinguishes patterns through which economic life can be integrated, including reciprocity, redistribution, and exchange (Polanyi 1957). The importance of this distinction lies in rejecting the assumption that market exchange supplies the universal template for every form of economic coordination. Reciprocity can organize flows through socially structured relationships; redistribution can organize movement toward and from a center; exchange can operate through price-making markets. Historical economies can combine these patterns rather than corresponding to one pure type.

The modern solidarity-economy literature develops these concerns within democratic and associational economic practice. Laville describes solidarity economy as a diverse international movement involving cooperativism, associations, self-management, participatory democracy, and efforts to democratize economic activity (Laville 2010). In this tradition, solidarity is not simply a private feeling of altruism.



It can be institutionalized through organizations, reciprocal commitments, collective ownership, public support, mutual aid, and forms of economic participation that join productive activity to social or political purposes.

Cooperative principles offer one organizational articulation of this relation. The ICA identifies self-help, self-responsibility, democracy, equality, equity, and solidarity among cooperative values, while the principle of cooperation among cooperatives extends economic coordination beyond the boundary of an individual enterprise (International Cooperative Alliance 1995). Such inter-cooperation can involve federations, purchasing networks, shared finance, education, insurance, or common infrastructures. Solidarity can therefore acquire organizational form rather than remaining an interpersonal disposition.

These traditions should nevertheless remain analytically separate. Reciprocity can occur inside households, markets, associations, or political communities without producing a cooperative enterprise. A cooperative can operate successfully while its relations with nonmembers remain conventional market relations. A commons can depend heavily on rules and sanctions rather than on generalized solidarity. Solidarity-economy organizations can combine market revenue, public subsidy, unpaid participation, redistribution, and reciprocal activity. The historical field is plural precisely because no single institutional principle coordinates all of these arrangements.

A further caution concerns normative evaluation. Reciprocity can sustain exclusionary communities; solidarity can be bounded to insiders; democratic organizations can reproduce informal hierarchy; collectively owned assets can be captured by a subset of members. The existence of a shared resource or participatory rule does not establish distributive, relational, or procedural justice. Conversely, the persistence of market exchange within a cooperative or solidarity economy does not by itself negate collective governance. Institutional combinations require analysis at the level of actual rights, obligations, access, decision procedures, and distributions of benefit and burden.

The conceptual inheritance for later GR and GRE can therefore be stated with some precision. Commons scholarship establishes that shared-resource outcomes depend on institutions and collective capacities. Cooperative traditions establish that ownership, control, production, and surplus allocation can be organized through democratic membership. Shared-infrastructure approaches show how open or collectively governed foundations can enable heterogeneous downstream activities. Reciprocity and solidarity traditions identify economic coordination that is structured through obligation, association, mutual aid, and collective purpose as well as price and command. None of these traditions alone supplies a complete generative-relational economics. Together they make it possible to ask later how shared resources, governance capacities, cooperative relations, infrastructures, and solidaristic commitments are generated, how they reproduce or transform the relations among participants, and how value created through collective arrangements circulates, returns, or becomes captured. The present section therefore provides foundations for those later questions without resolving them in advance.

## 2.25 Evolutionary Economics

The preceding sections reconstructed institutional, relational, capability, care, commons, and solidarity traditions that widened economic analysis beyond static exchange among already constituted agents. The present section turns to evolutionary economics, a heterogeneous family of approaches united less by one formal model than by a sustained concern with cumulative change, novelty, heterogeneity, selection, organizational memory, technological development, and historically conditioned transformation. Its role is genealogical. Its objective is to reconstruct the concepts of variation, selection, retention, innovation, and coevolution as they developed across institutionalist, Schumpeterian, Darwinian, and Nelson–Winter lineages before identifying what those concepts make available for later GR and GRE. The discussion therefore treats biological evolution as one source of conceptual resources rather than as a template that can be transferred mechanically into economic explanation.

The term *evolutionary* has been used in economics in several importantly different senses. Veblen used it to criticize taxonomic and equilibrium-centered conceptions of economic life and to emphasize cumulative causation, habits, institutions, and changing material conditions (Veblen 1898). Schumpeter centered economic development on innovation and the disruption of established combinations (Schumpeter 1934). Nelson and Winter later constructed an explicit evolutionary theory of firms and industries around routines, search, innovation, differential performance, and selection (Nelson and Winter 1982). Alchian developed a separate selection argument in which uncertainty and competitive survival can generate observed regularities without requiring complete foresight by firms (Alchian 1950). Hodgson subsequently emphasized both the intellectual importance and the hazards of importing evolutionary concepts from biology into economics (Hodgson 1993). These traditions overlap, but variation, selection, retention, innovation, and coevolution do not carry identical mechanisms across them.

### 2.25.1 Variation

An evolutionary explanation requires heterogeneity. If all relevant actors, routines, technologies, organizational forms, and strategies were identical and remained so, there would be little for a selective process to differentiate. Yet economic variation is not analogous to a single biological mechanism of mutation. It can arise through deliberate search, error, experimentation, recombination, imitation with modification, entrepreneurial judgment, scientific discovery, organizational learning, institutional conflict, or changes in material and political conditions. Evolutionary economics therefore begins by treating difference among economic forms as an explanatory object rather than as temporary noise around a representative agent.

Veblen's evolutionary critique already placed cumulative variation inside economic conduct. Habits of thought, institutions, technological practices, and material circumstances change together over historical time; economic behavior is consequently formed within a moving institutional environment rather than generated repeatedly from an invariant psychological calculus (Veblen 1898). Variation in this

tradition is historical and institutional. New practices arise from changing conditions and from tensions among inherited habits, technical possibilities, and collective arrangements.

Nelson and Winter give variation a more organizationally specific form. Firms possess routines that stabilize recurrent behavior, but they also engage in search when performance is unsatisfactory, when technological opportunities emerge, or when competitive environments change (Nelson and Winter 1982). Search can produce modified techniques, products, organizational procedures, investment strategies, or other departures from established routines. The resulting variation is partly intentional but not fully designed: firms search under bounded knowledge, uncertain outcomes, and heterogeneous inherited capabilities. What can be tried depends on what the organization already knows how to do.

This point separates evolutionary variation from an abstract random-shock model. Economic novelty often has a genealogy. A firm may experiment in a direction because its engineers possess particular skills, because previous investments have created complementary capabilities, because regulations permit one organizational form rather than another, or because a scientific development makes a new technological path imaginable. Variation can therefore be locally contingent while remaining historically structured. The space of possible variants is neither fixed nor equally accessible to all actors.

Hodgson's reconstruction of evolutionary economics is useful precisely because it cautions against a literal biological analogy. Economic variation can be reflexive, purposive, institutionally mediated, symbolically represented, and transmitted through teaching or documentation in ways that differ from genetic variation (Hodgson 1993). Later generalized-Darwinian work has argued that variation, inheritance, and selection can still provide high-level explanatory principles for social evolution, while recognizing that the mechanisms realizing those principles differ across biological and social domains (Hodgson and Knudsen 2010). Chapter 2 need not resolve that debate. The foundational point is that evolutionary economics treats economic heterogeneity as generated and historically conditioned rather than merely assumed.

For later GRE, this lineage leaves an important analytical question: what generates the set of alternatives upon which later selection can act? Evolutionary economics already makes clear that selection cannot explain variation by itself. The origins, accessibility, and distribution of economic alternatives require separate explanation.

### 2.25.2 Selection

Selection concerns differential persistence or expansion among heterogeneous economic forms. Here again, evolutionary economics contains several distinct mechanisms. Alchian's classic argument begins from uncertainty. Firms need not maximize profits through complete knowledge in order for competitive environments to favor some behaviors over others. Practices compatible with positive realized profits can survive while others disappear, so observed regularities may partly reflect environmental selection rather than perfect *ex ante* optimization (Alchian 1950). The mechanism is deliberately different from a claim that managers consciously solve an optimization problem.

Nelson and Winter place selection within an industry population of heterogeneous firms. Firms differ in routines, productivity, technologies, and search behavior. Market competition, profitability, investment, entry, and exit can alter their relative weights over time (Nelson and Winter 1982). Selection therefore operates on organizations carrying historically accumulated routines and capabilities. It can change an industry's composition even when no individual firm instantaneously adopts the globally best technique.

Metcalf develops a related evolutionary interpretation of competition in which economic variety is a precondition for competitive change and innovation is a major source of differences among firms (Metcalf 1998). Competition in this view is a process that transforms population shares rather than merely a static state described by an equilibrium price vector. This places market coordination and evolutionary selection in relation without making them identical. Price competition can be one selective mechanism, while credit access, regulation, standards, procurement, network position, professional legitimacy, intellectual property, and political authority can also affect which organizational or technological forms persist.

Selection therefore does not imply that whatever survives is efficient, optimal, or normatively desirable. A technology can persist because switching costs are high; an organizational form can expand because it controls infrastructure or finance; a standard can dominate through network effects; an institution can survive because it benefits actors capable of defending it. Selection describes differential continuation under specified conditions. It does not transform survival into a welfare criterion.

Nor is the selection environment external and fixed. Firms alter markets through innovation; technologies change input requirements and complementary infrastructures; regulation responds to new industries; user practices reshape demand; and successful organizational forms can influence the rules under which subsequent competition occurs. Evolutionary economists therefore increasingly moved from simple selection metaphors toward models in which the environment itself changes with the population being selected.

For later GR and GRE, the inheritance is again methodological rather than doctrinal. Selection directs attention to differential persistence among heterogeneous relations, routines, institutions, and organizations. It also imposes a discipline: an evolutionary explanation should specify the mechanism and level of selection rather than invoke "selection" as a generic synonym for historical change.

### 2.25.3 Retention

Selection can have cumulative consequences only if economically consequential differences persist long enough to influence later behavior. Evolutionary economics therefore requires some account of retention, inheritance, memory, or reproduction. In biological evolution, inheritance is associated principally with genetic transmission. Economic systems possess no single equivalent mechanism. Retention can occur through organizational routines, skills, records, standards, legal rules, infrastructures, habits, professional training, technical artifacts, organizational culture, supply relations, and institutions.

Nelson and Winter's concept of routine is central to this problem. Routines are re-

current patterns through which organizations remember and reproduce productive and organizational capabilities (Nelson and Winter 1982). They can govern technical procedures, information processing, hiring, investment, coordination, or search. Their importance is not that firms never depart from them, but that economic action cannot be reconstructed anew from complete calculation at every moment. Organizations inherit practical repertoires that condition what they can reliably do.

Retention also helps explain why capabilities are unevenly distributed. A technique written in a manual may not be equivalent to the organizational capacity to perform it. Skills may depend on tacit knowledge, coordinated teams, accumulated experience, specialized equipment, supplier relations, or institutional support. The persistence of an economic form can therefore depend on a bundle of complementary carriers rather than on the survival of an abstract idea alone.

Dosi's distinction between technological paradigms and technological trajectories provides another account of cumulative retention. Once a technological paradigm has become established, technical problem-solving often proceeds along relatively structured trajectories, while more discontinuous changes are associated with the emergence of new paradigms (Dosi 1982). Retention here concerns more than organizational memory. It includes stabilized problem definitions, heuristics, technical competencies, investment commitments, and expectations about promising directions of improvement.

Retention is consequently compatible with transformation. Routines can be modified during enactment; standards can be revised; institutions can reinterpret inherited rules; skills can be recombined; and technological trajectories can encounter bottlenecks that redirect search. Evolutionary persistence is not simple repetition. The object retained may be a capacity for patterned variation rather than an invariant behavior.

This distinction matters for later GRE because historical continuity can operate through many carriers. An economic relation may persist because contracts are renewed, because infrastructures make alternatives costly, because participants acquire relation-specific skills, because law recognizes a status, or because expectations become mutually reinforcing. Evolutionary economics supplies the broader lesson that continuity itself requires mechanisms. GR can later ask how such carriers of retention are generated and how their persistence changes the conditions of subsequent variation.

#### **2.25.4 Innovation**

Innovation occupies a distinctive position in evolutionary economics because it can generate variation while simultaneously altering the environment in which future selection occurs. Schumpeter's theory of economic development describes development through the carrying out of "new combinations": new goods, new methods of production, new markets, new sources of supply, and new forms of organization (Schumpeter 1934). The entrepreneur is defined by the function of carrying out such combinations rather than by permanent ownership of a particular firm. Economic development is therefore distinguished from the circular reproduction of an already established configuration.



This Schumpeterian lineage makes novelty endogenous to economic development. Innovation is not merely an external technological shock applied to an otherwise stationary market system. Credit, entrepreneurship, organizational power, knowledge, competition, and institutional arrangements help determine whether a technically possible novelty becomes economically operative. Later Schumpeterian analysis also emphasizes the destructive side of innovation: new combinations can render existing competencies, capital goods, organizational forms, and market positions obsolete.

Nelson and Winter translate part of this insight into an organizational evolutionary framework. Innovation emerges from search performed by firms with heterogeneous routines and capabilities; successful innovations affect profitability and growth, changing the population of firms and the direction of subsequent search (Nelson and Winter 1982). The relation between innovation and selection is therefore recursive. Innovation supplies new variants, while prior selection shapes the organizations and capabilities from which later innovation can emerge.

Dosi adds a further distinction between innovation within an established technological trajectory and more discontinuous changes associated with new paradigms (Dosi 1982). His argument also rejects one-directional accounts in which either scientific advance or market demand alone determines technological change. Scientific knowledge, unresolved technical problems, economic incentives, institutions, and previous technological commitments interact in shaping what directions become technically and economically plausible.

Innovation should therefore not be equated with invention. An invention can remain economically marginal; an innovation involves incorporation into productive, organizational, or market practice. Nor does innovation imply improvement in every evaluative dimension. A new technology can increase productivity while intensifying environmental damage, surveillance, labor displacement, dependence, or concentration of power. Evolutionary economics explains novelty and diffusion; normative evaluation requires additional criteria.

The later GRE relevance lies in treating innovation as a transformation of capacities and relations rather than only the appearance of a new product. An innovation can create new complementarities, dependencies, professions, infrastructures, standards, and categories of economic actor. Chapter 2 should preserve this as an inherited problem rather than pre-empt the later GR theory of generativity.

### 2.25.5 Coevolution

The concept of coevolution extends evolutionary economics beyond the idea that one population adapts to an independently given environment. Economic change frequently involves reciprocal transformation among technologies, firms, industrial structures, institutions, skills, demand patterns, infrastructures, and regulatory arrangements. When change in one domain alters the selective conditions of another, which in turn feeds back into the first, the analytical problem is coevolutionary.

Nelson's account of the coevolution of technology, industrial structure, and supporting institutions gives this problem a clear sectoral formulation (Nelson 1994). Technologies develop along trajectories; firm and industry structures change as technical opportunities and competitive conditions change; institutions develop in re-

sponse to new economic pressures and capabilities. The causal architecture is therefore not one-directional. Institutional arrangements can accelerate or inhibit technological development, while technological change can generate new institutional demands.

Murmann's comparative study of the synthetic-dye industry provides a historically grounded extension of this approach. Differences among British, German, and American firms cannot be explained adequately through firm capabilities, national institutions, or technological knowledge in isolation. The development of firms, technological knowledge, educational institutions, patent systems, and national industrial structures formed a coevolutionary process with different outcomes across countries (Murmann 2003). The example is useful because it demonstrates that coevolution need not imply synchronized or harmonious change. Complementarities can emerge unevenly; one domain can lag another; and historically contingent institutional configurations can redirect industrial development.

Coevolution also modifies the interpretation of selection and retention. A routine that is advantageous under one technological regime may become maladaptive after infrastructure or regulation changes. An institution that initially supports innovation can later stabilize incumbents and inhibit entry. A new technological capability can alter what kinds of regulation are administratively feasible. Retention mechanisms can therefore help reproduce a system while also becoming objects of selection when complementary domains change.

This literature provides an important foundation for later GR because it relaxes the assumption that the conditions of economic change remain fixed while actors change within them. Yet coevolution is still not identical to GR's later concept of generativity. Coevolution generally establishes reciprocal historical dependence among changing domains. A stronger generative analysis asks how those interactions produce new actors, relations, capacities, constraints, evaluative categories, and transformation rules that were not available in the same form beforehand.

The intellectual inheritance of evolutionary economics can therefore be summarized without turning Chapter 2 into a new evolutionary theory. Variation makes heterogeneity endogenous; selection explains differential persistence under specified environments; retention identifies mechanisms through which historically accumulated differences endure; innovation introduces novelty capable of reorganizing competitive and institutional conditions; and coevolution analyzes reciprocal change among multiple domains. None of these concepts by itself establishes progress, efficiency, justice, or a universal Darwinian ontology. Together, however, they provide GRE with an indispensable vocabulary for economic processes in which the relevant actors, capabilities, technologies, institutions, and environments are historically changing rather than analytically fixed.

## 2.26 Ecological Economics

The preceding sections reconstructed evolutionary approaches to economic change after examining institutions, capabilities, care, commons, and social reproduction. The present section turns to ecological economics, a heterogeneous interdisciplinary

tradition concerned with the dependence of economic activity on material, energetic, and ecological processes. Its role is genealogical. Its objective is to reconstruct five conceptual resources that later become important for GRE: material and energy flows, ecological constraints, human–ecological interdependence, intergenerational relations, and regeneration or ecological capacity. The discussion proceeds by distinguishing ecological economics from narrower applications of conventional allocation theory to environmental problems while also avoiding the opposite reduction in which economic value, institutions, or social conflict are dissolved into biophysical accounting. Costanza’s early programmatic statement described ecological economics as inquiry into relationships between ecosystems and economic systems in the broadest sense and explicitly presented environmental and resource economics as only part of that wider field (Costanza 1989). This section therefore treats ecological economics as a plural research tradition rather than as one settled model of nature, value, or sustainability.

Several lineages converge in this tradition without becoming equivalent. Biophysical economics emphasizes throughput, energy, materials, and thermodynamic irreversibility. Systems approaches analyze feedback, accumulation, delay, resource depletion, and pollution. Sustainability theory studies the scale of economic activity relative to ecological capacities and disputes the substitutability of manufactured and natural capital. Social–ecological research examines institutions and ecosystems as coupled systems. Resource economics develops formal accounts of depletion and intergenerational allocation. Ecological economics inherits from all of these while adding questions concerning scale, uncertainty, irreversibility, valuation, distribution, and the relation between human economies and the ecological conditions that sustain them. The resulting conceptual field is broader than an account of environmental externalities alone.

### 2.26.1 Material and Energy Flows

A foundational move in ecological economics is to represent the economy as materially open rather than as a self-contained circulation of money and commodities. Production requires energy and material inputs drawn from ecological systems; consumption and production return residuals, heat, emissions, and transformed matter to those systems. Monetary circulation can therefore remain balanced while physical stocks, sinks, and energetic conditions change substantially. The economic process is embedded in a material throughput that cannot be reconstructed from prices alone.

Ayres and Kneese provided an influential material-balance formulation of this problem. Their analysis connected production, consumption, residuals, and environmental externalities through the conservation of matter: materials entering economic activity do not disappear when market transactions are completed, but eventually become products, wastes, emissions, or accumulated stocks (Ayres and Kneese 1969). The significance of this argument is methodological as much as environmental. Pollution cannot always be treated as an accidental side effect attached to an otherwise closed production process. Residual generation follows from the material transformation through which production and consumption occur.

Georgescu-Roegen developed a stronger thermodynamic critique. In *The Entropy*

*Law and the Economic Process*, he argued that economic activity transforms available low-entropy matter and energy into less available forms and that the economic process therefore cannot be represented adequately as a reversible mechanical circulation (Georgescu-Roegen 1971). This argument became one of the principal intellectual foundations of ecological economics. It directs attention toward irreversibility, qualitative degradation, and the physical conditions of reproduction over time.

Thermodynamic reasoning nevertheless requires restraint when translated into economics. The entropy law does not by itself determine prices, rights, distributive institutions, technological choices, or normative priorities. Nor does it establish an energy theory of economic value. A physical accounting of joules or tonnes and an economic theory of valuation answer different questions. Ecological economics is strongest when biophysical constraints and social valuation remain connected but analytically distinct.

The systems tradition reinforced this attention to stocks, flows, feedback, and delay. *The Limits to Growth* modeled interactions among population, industrial production, food, nonrenewable resources, and pollution in a finite global system (Meadows et al. 1972). Whatever one concludes about particular scenarios, the work helped make coupled accumulation, delayed feedback, and overshoot legitimate economic questions. A system may continue expanding for a period even while depleting stocks or degrading sinks whose consequences arrive later. Material throughput therefore introduces temporal structures that are poorly represented by instantaneous exchange alone.

For later GRE, the inheritance is not the proposition that economic reality should be reduced to physical flows. It is the more limited requirement that relational economic analysis remain capable of following the material and energetic carriers through which production, consumption, infrastructure, and ecological consequence are connected. A relation that appears economically productive at one boundary may simultaneously transfer material costs or sink burdens elsewhere.

### 2.26.2 Ecological Constraints

Ecological economics also changes the status of constraint. In conventional allocation problems, constraints often enter as given resource endowments, technologies, or feasibility conditions. Ecological analysis asks how those constraints are produced by biophysical processes, how quickly they can change, whether they contain thresholds, and whether economic activity alters the future feasible set itself. The relevant issue is therefore not simply scarcity within a fixed environment but the changing ecological scale within which economic activity takes place.

Daly's operational principles of sustainable development express this shift in deliberately biophysical terms. Renewable-resource use should remain within regenerative capacity, waste emissions within assimilative capacity, and depletion of nonrenewable resources should be accompanied by investment in renewable substitutes capable of supporting future services (Daly 1990). These principles are not a complete theory of sustainability, but they make explicit that economic throughput must be evaluated against processes of renewal and absorption rather than only against contemporaneous willingness to pay.

The associated natural-capital literature sharpened a dispute over substitutability. Costanza and Daly argued that maintaining natural-capital stocks is a prudent minimum condition under substantial uncertainty and questioned the assumption that manufactured capital can safely substitute for ecological functions without important limits (Costanza and Daly 1992). This position differs from resource-economic approaches in which sufficiently productive investment may compensate for depletion. The disagreement is substantive: it concerns which ecological functions are replaceable, at what scale, under what knowledge, and with what consequences if substitution fails.

The modern planetary-boundaries literature expresses a related concern at Earth-system scale. Steffen and colleagues identify biophysical processes whose perturbation can move the Earth system away from the relatively stable conditions under which contemporary human societies developed (Steffen et al. 2015). Planetary boundaries are not market prices, welfare weights, or legal limits. They are a scientific framework for reasoning about nonlinear Earth-system change and risk. Their economic relevance arises when production and consumption alter the processes upon which later social and economic possibilities depend.

Ecological constraints should therefore not be interpreted as a static catalogue of immutable ceilings. Technologies, institutions, consumption patterns, ecological restoration, and substitution can change pressures and capacities. At the same time, the possibility of adaptation does not imply universal substitutability. Some losses are irreversible at relevant human timescales; some processes exhibit thresholds; and some ecological functions cannot be recreated simply by increasing another category of capital. Ecological economics makes these uncertainties part of the economic problem rather than external qualifications added afterward.

This creates a useful distinction for later GRE: a constraint can be exogenous to a local economic model while remaining historically endogenous to the larger social-ecological system. Economic activity may consume, regenerate, relocate, or transform the very capacities that condition subsequent activity. Chapter 2 records this as an inherited analytical possibility rather than yet converting it into a full generative formalism.

### 2.26.3 Human–Ecological Interdependence

A third lineage moves beyond the language of environmental impact toward reciprocal human–ecological interdependence. The environment is not simply an external recipient of economic externalities, and the economy is not simply a subsystem whose behavior is mechanically determined by ecology. Institutions, technologies, cultural practices, infrastructures, and ecosystems develop through reciprocal influence. The analytical problem is therefore one of coupled systems with heterogeneous causal processes.

Norgaard’s coevolutionary account is an important formulation of this position. He describes development as coevolution among ecological and cultural systems and criticizes explanations that imagine one universal trajectory of progress through increasing human control over nature (Norgaard 1994). The coevolutionary perspective makes both directions of change visible: social organization alters ecological



processes, while ecological changes reshape technologies, knowledge, livelihoods, institutions, and cultural possibilities.

Ostrom's framework for social–ecological systems provides a more institutionally structured approach. It identifies resource systems, resource units, governance systems, users, interactions, and outcomes as analytically connected components whose relationships vary across cases (Ostrom 2009). The framework does not assume that either ecological variables or institutional variables alone determine sustainability. It instead supports comparative inquiry into how attributes at several levels combine to produce different outcomes.

The ecosystem-services and natural-capital literature adds another route into interdependence. Costanza and colleagues emphasized that ecological systems perform functions critical to human life and economic activity and attempted to estimate the magnitude of those services in monetary terms (Costanza, d'Arge, et al. 1997). The historical importance of this work does not require treating monetary valuation as exhaustive. Ecosystems can be economically consequential even where their contributions are difficult to price, imperfectly substitutable, culturally contested, or necessary for conditions that precede market exchange itself.

This point also limits the metaphor of nature as a stock of assets. Natural-capital language can make ecological dependence legible to economic analysis, but it can obscure ecological relations if every function is imagined as a separable asset with a market-equivalent substitute. Ecological economics therefore contains an enduring tension between valuation strategies that translate ecological functions into economic metrics and pluralist approaches that preserve biophysical, cultural, ethical, and relational dimensions that resist complete commensuration.

Human–ecological interdependence consequently expands the domain of economically relevant relation. Food systems connect soils, water, climate, labor, knowledge, institutions, and infrastructures. Cities depend on distant energy and material systems. Public health depends on environmental conditions shaped by production and settlement. Ecological changes can alter migration, livelihoods, conflict, insurance, public finance, and future productive capacity. These relations are neither purely ecological nor purely economic, and their causal structure frequently crosses institutional and spatial boundaries.

For later GRE, this lineage opens the possibility of analyzing ecological systems not only as constraints on economic actors but also as participants in the generation of economic capacities and vulnerabilities. The stronger ontological question of whether ecosystems should themselves be treated as economic subjects, agents, or rights-bearing entities belongs elsewhere. Chapter 2 requires only the more modest conclusion that economic possibility is partly constituted through relations with nonhuman systems.

#### **2.26.4 Intergenerational Relations**

Ecological economics also makes time ethically and analytically unavoidable. Resource depletion, infrastructure, pollution stocks, biodiversity loss, climate change, and ecological restoration distribute consequences across generations that do not coexist symmetrically in markets or political institutions. Present actors can alter

the opportunity sets of future persons who cannot bargain with them directly. Intergenerational analysis therefore connects ecological constraint to questions of capital, substitution, uncertainty, and justice.

Mainstream resource economics developed one influential route into this problem. Solow's analysis of exhaustible resources asks under what conditions an economy using a finite natural-resource stock can sustain consumption across generations and emphasizes the possibilities created by reproducible capital and substitution (Solow 1974). Hartwick subsequently derived the well-known result that, in a particular aggregate model, investing resource rents in reproducible capital can support constant per-capita consumption along an efficient path (Hartwick 1977). These results are important precisely because they show that intergenerational sustainability can be formulated inside conventional growth and capital theory.

Ecological economics does not simply discard this lineage. It questions the conditions under which its compensating substitutions are adequate. If a depleted ecological function has no close substitute, if thresholds are uncertain, if ecological losses are irreversible, or if different forms of capital contribute qualitatively different conditions of life, then maintaining an aggregate capital value may be insufficient. Costanza and Daly's natural-capital argument makes this disagreement explicit by treating uncertainty about substitutability as a reason for preserving ecological stocks rather than assuming replacement in advance (Costanza and Daly 1992).

Intergenerational relations also expose the limitations of preference aggregation restricted to presently existing market participants. Discount rates, property rights, public debt, conservation rules, infrastructure standards, and environmental law can redistribute ecological possibilities through time even where future persons have no present voice. These mechanisms do not establish one correct theory of intergenerational justice. They demonstrate that temporal relations can be institutionally mediated and economically consequential despite the absence of contemporaneous exchange.

The distinction between sustainability and justice should remain visible. A trajectory may preserve some aggregate measure of productive or natural capital while distributing risks and benefits unequally. Conversely, a normatively attractive distribution at one date may still erode ecological conditions required for continuation. Ecological economics therefore contributes to Chapter 2 by making the temporal reproduction of opportunity an explicit economic object, while the fuller normative evaluation of intergenerational relations remains connected to the justice traditions reconstructed earlier.

For later GRE, the important inheritance is the possibility that economic evaluation must track not only present allocations but also how current relations alter the capacities available to subjects who appear later in historical time. The relevant relation can be real and causally structured even when its parties are not simultaneously present.

### 2.26.5 Regeneration and Ecological Capacity

The final concept concerns ecological capacity. Sustainability is sometimes described negatively as avoiding depletion or remaining within limits. Ecological traditions also contain a more dynamic vocabulary of renewal, assimilation, resilience, recovery, and regeneration. These concepts direct attention toward the processes through which ecological systems maintain or reconstitute capacities over time.

Daly's operational principles already distinguish a renewable stock from the regenerative process that renews it and a waste sink from the assimilative process through which some residuals can be absorbed (Daly 1990). This distinction matters economically. The same current stock can support very different future possibilities depending on rates of renewal, degradation, extraction, and recovery. Ecological capacity is therefore not adequately described by a snapshot of available resources.

Holling's classic distinction between resilience and stability further complicated equilibrium-centered representations of ecology. Resilience concerns the capacity of ecological systems to absorb disturbance while maintaining important relationships, whereas stability concerns return toward an equilibrium condition after disturbance (Holling 1973). Later uses of resilience have expanded far beyond this original ecological problem, sometimes too loosely. In the present genealogy, its importance is narrower: persistence, recovery, and transformation cannot be inferred from the size of a resource stock alone.

Social-ecological analysis adds institutions to this problem of capacity. Ostrom's framework makes sustainability dependent on interactions among ecological attributes, users, governance arrangements, monitoring, and feedback rather than on ecological variables in isolation (Ostrom 2009). Norgaard's coevolutionary perspective similarly implies that ecological and social capacities can change together (Norgaard 1994). Regeneration may therefore depend on social restraint, collective maintenance, knowledge, infrastructure, rights, and governance as well as on biophysical processes.

The language of regeneration nevertheless requires the same normative caution applied earlier to resilience and evolutionary survival. A system can reproduce or recover while preserving unequal access, harmful production, exclusion, or ecologically undesirable states. Regeneration is a claim about the renewal or enhancement of some specified capacity; it does not by itself establish what ought to be regenerated, for whom, at what scale, or under which distribution of burden and authority.

This genealogy prepares the transition to circular and regenerative economic thought in the next section. Ecological economics supplies the biophysical foundation: throughput is material, sinks and stocks have capacities, renewal takes time, and ecological systems can lose or recover functions. Circular-economic traditions will ask how production and consumption can be reorganized to reduce virgin throughput, waste, and loss through reuse, repair, recycling, and redesign. The two problems overlap but are not identical. A materially circular process can still exceed energy, land, biodiversity, or sink constraints, while ecological regeneration can involve processes that are not reducible to closing industrial material loops.

For later GRE, ecological economics therefore leaves a precise but incomplete inheritance. Economic relations operate within material and energetic flows; they en-

counter ecological limits; they depend on nonhuman systems; they transmit consequences across generations; and they can degrade or support the capacities upon which subsequent economic activity depends. GR and GRE can later ask how those capacities become generated, eroded, regenerated, and redistributed through evolving relations. Chapter 2 stops at the foundation: ecological capacity is historically dynamic and economically consequential, while its full generative-relational representation remains to be developed.

## 2.27 Circular and Regenerative Economic Thought

Ecological economics establishes that economic activity is materially open, ecologically embedded, and dependent on regenerative capacities that cannot be inferred from monetary circulation alone. The present section turns from that biophysical foundation to traditions that ask how production and consumption might themselves be reorganized around recirculation, product-life extension, restoration, and renewal. Its role is genealogical. Its objective is to reconstruct five conceptual resources that later become important for GRE: circular resource flows, reuse and recirculation, regenerative production, systemic value retention, and the limits of circularity and regeneration as economic models. The discussion distinguishes industrial ecology, circular-economy strategies, cradle-to-cradle and regenerative-design traditions, and critical circular-economy research. These traditions overlap, but they do not define the same analytical object and should not be treated as stages of a single unified doctrine.

Circular economic thought emerged from several antecedents rather than from one founding theory. Industrial ecology asked whether industrial systems could be reorganized so that residuals from one process became inputs to another. Product-life approaches shifted attention from throughput reduction toward durability, repair, reuse, remanufacture, and the preservation of embodied labor and material value. Circular-economy frameworks later assembled these concerns into broader strategies for closing or slowing resource loops. Regenerative design went further in a different direction by asking whether human systems could participate in the renewal and development of ecological capacities rather than merely reduce damage. Critical scholarship then exposed conceptual ambiguity, rebound effects, thermodynamic limits, spatial displacement, and the weak treatment of social justice in many circular-economy formulations. The resulting field is therefore best read as a contested family of approaches to recurrence, retention, renewal, and system redesign.

### 2.27.1 Circular Resource Flows

One intellectual foundation of circular economic thought lies in industrial ecology. Frosch and Gallopoulos proposed an “industrial ecosystem” in which wastes from one industrial process could become resources for another, reducing the dependence of production on continuous extraction and disposal (Frosch and Gallopoulos 1989). The analogy to ecological systems was deliberately organizational: the industrial economy could be examined as a network of material and energy transformations whose outputs need not terminate at the boundary of each individual firm. This refram-

ing made the connections among facilities, sectors, and residual streams analytically visible.

Chertow's later account of industrial symbiosis gave this idea greater institutional specificity. Industrial symbiosis concerns collaborative exchanges of materials, energy, water, and by-products among organizations that would otherwise be treated as separate production units (Chertow 2000). Geographic proximity can matter because transport costs and material characteristics shape feasible exchanges, but proximity alone does not generate symbiosis. Firms must identify compatible flows, develop information channels, coordinate investments, establish reliable expectations, and often create governance arrangements capable of sustaining multi-party exchange. Circularity therefore already contains a relational and institutional problem: a technically reusable residual becomes an economic input only when organizational relations allow the conversion to occur.

The circular-economy literature subsequently generalized these linked flows beyond industrial by-product exchange. Stahel's product-life approach emphasizes maintaining goods, components, and materials in economically useful circulation for longer periods through maintenance, reuse, repair, upgrading, and remanufacture (Stahel 2016). The analytical boundary shifts from a single production event toward the life history of products and assets. A durable object can move through several users, service arrangements, repair cycles, ownership configurations, and component recoveries before its constituent materials are recycled or discarded.

These lineages establish a useful distinction between a *linear flow* and a *recirculating flow*, but the distinction should remain physically and institutionally precise. A material stream can circulate through several economic uses while still requiring virgin inputs, energy, infrastructure, chemicals, transport, or replacement materials. Circularity is therefore a property of specified flows within a defined boundary rather than an automatic description of an entire economy. Haas and colleagues' material-flow assessment of the global economy illustrates this point empirically: recycling and recirculation coexist with large primary material inputs, energetic uses, long-lived stocks, and outputs that cannot simply be returned to production (Haas et al. 2015).

The scale of observation also matters. A factory can appear circular because its residuals are exported to another facility; a regional industrial network can appear circular while relying on imported primary materials; a national accounting boundary can omit ecological burdens displaced through international supply chains. Circular resource analysis therefore requires specification of what circulates, through which organizations, across which spatial boundary, over what period, and with which additional inputs. Circularity becomes analytically useful when it describes a concrete configuration of flows rather than functioning as a synonym for sustainability.

For later GRE, the inheritance is limited but important. Industrial ecology and circular-flow analysis show that one process can alter the resource conditions of another process and that economic value can depend on relations among material streams, organizations, infrastructures, and temporal stages. The stronger question of how those relations generate new capacities or transform the conditions of future economic action remains beyond the present genealogy.



### 2.27.2 Reuse and Recirculation

Circular economic thought also differentiates among ways of extending the economic life of products, components, and materials. Reuse, maintenance, repair, refurbishment, remanufacture, repurposing, and recycling all recirculate something, but they preserve different portions of the prior product's organization and require different levels of additional processing. Treating them as one undifferentiated act of "recycling" obscures the economic significance of product integrity, embedded labor, technical function, information, and user relations.

Stahel's circular-economy formulation gives priority to strategies that preserve products and components because much of the economic effort embodied in manufacturing can remain available when an object is maintained, repaired, reused, or remanufactured (Stahel 2016). Material recycling, by contrast, can recover material while destroying much of the product-specific structure into which labor, design, energy, and organizational knowledge had previously been invested. Circularity therefore contains a temporal hierarchy of possible interventions: extending a functioning product's life is analytically different from recovering constituent materials after the product has been dismantled.

Bocken and colleagues formalize related distinctions through product-design and business-model strategies for slowing and closing resource loops (Bocken et al. 2016). Slowing loops concerns durability, long product life, maintenance, and service arrangements that reduce the frequency with which products must be replaced. Closing loops concerns bringing materials back into production after use. Resource efficiency can reduce material intensity, but efficiency alone does not establish either slower or closed circulation. These distinctions help prevent a circular economy from being reduced to end-of-pipe waste management.

Cradle-to-cradle design develops another influential lineage. Braungart, McDonough, and Bollinger contrast eco-effectiveness with strategies focused primarily on minimizing negative emissions or increasing efficiency. Their design framework seeks material cycles in which outputs are intentionally specified for continued use within biological or technical systems (Braungart et al. 2007). The importance of this tradition for Chapter 2 lies less in any universal claim that all materials can circulate indefinitely than in its shift of attention toward design at the beginning of the product life cycle. Future recirculation possibilities depend partly on earlier decisions concerning material composition, separability, toxicity, modularity, repairability, and the institutional arrangements through which products return.

Recirculation is consequently shaped before the moment of disposal. A product that is technically repairable may remain practically unrepairable if spare parts, diagnostic information, skilled labor, legal permissions, or service infrastructures are unavailable. A reusable object can become disposable when business models, warranty rules, fashion cycles, software support, or ownership structures shorten its effective life. Conversely, institutional changes can make previously discarded products economically recoverable. The circulation of material objects is therefore mediated by informational, legal, organizational, and cultural relations as well as by engineering properties.

This mediation also means that reuse cannot be evaluated only through the fact

of recurrence. Secondary markets can broaden access or preserve embodied value, but they can also move obsolete, hazardous, or low-quality goods to actors with less bargaining power. Repair can support local capability and employment, while repair restrictions can concentrate technical control elsewhere. Remanufacturing can reduce primary material demand under some conditions, while new logistics and processing requirements create other resource burdens. Circularity identifies a pattern of recirculation; evaluation of that pattern requires additional ecological, economic, and normative criteria.

For later GRE, reuse and recirculation provide an important temporal insight: value-bearing configurations can persist, be partially retained, be decomposed, and re-enter new processes. Yet recirculation alone does not tell us whether a later configuration reproduces an earlier economic relation or generates a qualitatively different one. That distinction becomes central when circularity is compared with regeneration and, later, with generativity.

### 2.27.3 Regenerative Production

Regenerative economic thought intersects with circularity while asking a different question. Circular approaches commonly begin from the flow of products, components, or materials and seek to reduce waste, slow throughput, or close loops. Regenerative traditions begin more directly from the condition and developmental capacity of living systems. Their characteristic concern is whether human activity can participate in the renewal, restoration, or enhancement of the ecological and social conditions upon which subsequent activity depends.

Lyle's *Regenerative Design for Sustainable Development* is an important early formulation of this orientation. Regenerative design treats ecological processes as active systems of renewal and asks how human design can work with cycles of energy, water, nutrients, landscape, and settlement rather than organize development around one-way consumption (Lyle 1994). The concept of regeneration therefore shifts attention from a static resource stock toward processes that maintain or restore capacities through time.

Reed later sharpened the distinction between reducing environmental damage and participating in the health of living systems. His regenerative-development argument criticizes sustainability practice when it becomes predominantly an exercise in efficiency and proposes a whole-systems, place-based approach in which human activity is situated within ecological relationships (Reed 2007). Mang and Reed further develop this approach as a methodology grounded in place, developmental processes, and the evolving relations among human and ecological systems (Mang and Reed 2012). In this lineage, regeneration cannot be represented adequately as a checklist of independently optimized environmental indicators because the object of intervention is the continuing capacity of an interconnected living system.

Cradle-to-cradle design intersects with this regenerative language through its concept of eco-effectiveness. Braungart and colleagues seek production systems whose material outputs can contribute positively to subsequent biological or technical cycles rather than simply become less harmful residuals (Braungart et al. 2007). This formulation expands the design objective from reducing quantities of waste toward

creating outputs with specified future roles. Yet the biological and technical cycles of cradle-to-cradle design should not be identified automatically with the place-based developmental claims of regenerative design. One is organized strongly around product and material specification; the other places greater emphasis on the evolving health and potential of living systems and places.

The distinction between circular and regenerative production can therefore be stated positively. Circularity concerns recurrence and recirculation within specified economic or material flows. Regeneration concerns renewal or development of a specified capacity. The two can coincide, but neither entails the other. A highly circular industrial loop can circulate toxic materials efficiently or reproduce an ecologically damaging scale of production. A regenerative ecological project can depend on non-circular external inputs while restoring soil fertility, watershed function, habitat, or other capacities. Analytical clarity requires identifying the object whose circulation or regeneration is being claimed.

Regeneration also raises a problem of evaluation. A system can regenerate one capacity while degrading another. Agricultural production might restore soil organic matter while depending on exploitative labor. A community enterprise might renew local skills while increasing pressure on water or land. An ecosystem can recover toward a state that is ecologically persistent but socially undesirable for particular human groups. Regenerative language therefore does not itself provide a complete economic or normative criterion. It describes a temporal relation between activity and the future capacity of a specified system.

For later GRE, the regenerative lineage offers a richer temporal vocabulary than conservation alone. Economic activity can consume capacities, maintain them, restore them, or contribute to their development. The later generative-relational question concerns how capacities of many kinds—ecological, technical, institutional, epistemic, and social—are produced through relations and how their transformation changes future possibilities. Chapter 2 retains regeneration as an inherited concept without yet converting it into that broader framework.

#### 2.27.4 Systemic Value Retention

The phrase *systemic value retention* is used here as an organizing label for a problem distributed across circular-economy, industrial-ecology, and product-life literatures. The issue is what remains available when an object, component, material, capability, or infrastructure passes through successive economic uses. Circularity can preserve more than physical matter: a maintained product can retain function, embodied labor, design, reliability, user familiarity, organizational knowledge, and access to an established service network. Different modes of recirculation retain different portions of these prior investments.

Stahel's emphasis on product-life extension makes this particularly visible. Maintenance, reuse, and remanufacture can preserve a larger share of a product's accumulated organization than material recovery after destruction (Stahel 2016). Bocken and colleagues' distinction between slowing and closing loops similarly implies that temporal extension and material recovery should not be treated as equivalent strategies (Bocken et al. 2016). An economy that recycles a high proportion of discarded

material after very short product lives may be materially more circular than a linear economy while still destroying substantial functional and economic value prematurely.

Industrial symbiosis extends the retention problem from products to interorganizational systems. A by-product can retain economic usefulness when another organization possesses a compatible process, transport connection, technical standard, contractual relation, and demand for the material (Chertow 2000). The same physical residual may therefore be valuable in one relational configuration and burdensome in another. What is retained is not reducible to matter alone; it includes the relational conditions that make the matter usable.

Systemic analysis also reveals that value retention at one level can coincide with value loss elsewhere. Extending the life of an incumbent technology can preserve material and financial value while delaying adoption of a less harmful alternative. Maintaining asset value for owners can increase maintenance burdens for users. Recycling can preserve material while destroying cultural significance or local employment. A circular business model can retain revenue streams while shifting environmental or care costs outside the accounting boundary. The language of value retention therefore requires specification of the relevant value form, subject, time horizon, and system boundary.

This problem becomes more difficult when values are heterogeneous. Economic exchange value, use value, ecological function, cultural significance, technical optionality, and social capability need not rise and fall together. The value-pluralism traditions reconstructed earlier in Chapter 2 already caution against assuming a common cardinal measure for every relevant form of value. Circular-economy strategies therefore cannot be evaluated by a single generic quantity called “retained value” unless the measure and its exclusions are made explicit.

The systemic qualifier also draws attention to sequence. Retention at one moment can affect later options. Repair can preserve a device long enough for another user to access it. Modular design can leave components available for later recombination. Open technical standards can preserve compatibility across generations of equipment. Conversely, proprietary lock-in, contamination, mixed materials, or information loss can destroy future recirculation possibilities before the physical object is discarded. A circular system is therefore partly constituted by the preservation of pathways through which future reuse remains feasible.

For later GRE, this literature prepares questions concerning circulation, retention, dissipation, and conversion across heterogeneous value forms. The present section stops before a distinct GRE theory of value recirculation. Its narrower conclusion is that circularity changes the temporal location of economic loss and preservation and that the value preserved through recirculation depends on material design, institutional relations, knowledge, infrastructure, and evaluative perspective.

### **2.27.5 Limits of Circularity and Regeneration as Economic Models**

The expansion of circular-economy discourse has generated an equally important critical literature. Kirchherr, Reike, and Hekkert’s analysis of 114 definitions shows that circular economy is used in substantially different ways, often with emphasis

on reduce–reuse–recycle activities and comparatively weak attention to systemic change, social equity, and future generations (Kirchherr et al. 2017). Geissdoerfer and colleagues likewise show that circular economy and sustainability overlap without being conceptually identical (Geissdoerfer et al. 2017). Circularity can therefore function as a useful analytical principle while remaining insufficient as a complete theory of sustainable economic organization.

The first limitation is physical. Cullen argues that a perfectly closed circular economy should be treated as a theoretical benchmark rather than as an attainable perpetual-motion system (Cullen 2017). Materials degrade, disperse, mix, corrode, or become uneconomic to recover; collection and separation require energy and infrastructure; and energy itself cannot be recirculated indefinitely without degradation. The thermodynamic foundations reconstructed in ecological economics therefore remain binding. Circular design can reduce primary throughput and waste, but it cannot abolish material and energetic dependence.

Empirical material-flow analysis reinforces this caution. Haas and colleagues show that large economies remain dominated by primary extraction, energetic uses, additions to long-lived stocks, and material outputs that are not immediately available for recycling (Haas et al. 2015). A circularity indicator can consequently improve while total throughput or ecological pressure remains high. The environmental significance of circular strategies depends on absolute scale, displaced production, energy systems, material quality, and the timing of stock turnover as well as on the fraction of material entering a secondary loop.

The second limitation concerns rebound. Zink and Geyer analyze how secondary production can lower prices, create additional demand, or fail to displace primary production sufficiently, thereby offsetting part of the intended environmental benefit of recycling or reuse (Zink and Geyer 2017). The existence and magnitude of rebound are empirical questions rather than automatic outcomes. Their importance is theoretical: a circular intervention changes markets and behavior, and its system-level consequence cannot always be inferred from the efficiency of the intervention considered in isolation.

The third limitation concerns system boundaries and governance. Korhonen, Honkasalo, and Seppälä identify physical, spatial, temporal, and organizational limitations in circular-economy reasoning and question formulations that imply a frictionless closure of economic loops (Korhonen et al. 2018). Materials and environmental burdens can be shifted geographically; one firm’s waste reduction can depend on another sector’s increased processing; benefits and costs can occur at different times; and the actors capable of redesigning products may differ from those responsible for collection or end-of-life treatment. Circularity therefore requires coordination across organizations whose incentives, authority, information, and capacities are heterogeneous.

A fourth limitation is normative. The recurrence of material or economic flows does not establish the justice of the relations through which they circulate. A circular supply chain can retain exploitative labor relations, concentrated ownership, unequal exposure to hazardous processing, or exclusion from repair and reuse infrastructures. A community can regenerate ecological capacity while distributing benefits and burdens unequally. The justice of a circular or regenerative arrangement



must therefore be assessed through additional distributive, procedural, relational, and historical criteria. Circularity and regeneration describe properties of processes; neither supplies a complete account of legitimate economic order.

These limitations clarify a final distinction important for the architecture of this book. *Circularity* concerns recurrence, recirculation, or loop closure within a specified flow. *Regeneration* concerns the renewal or development of a specified capacity. *Generativity*, in the later GR sense, concerns the production and transformation of capacities, subjects, relations, structures, and conditions that can alter what becomes possible subsequently. A process can be circular while repeatedly reproducing the same damaging institutional structure. A regenerative process can restore a capacity while leaving the relations governing access to that capacity unchanged. A generative transformation can create new relations or capabilities without itself being materially circular. These distinctions prevent circulation, renewal, and generation from being treated as equivalent simply because all are dynamic.

Circular and regenerative traditions nevertheless make an indispensable contribution to the genealogy of GRE. They direct attention away from terminal transactions toward sequences of use, maintenance, return, recovery, renewal, and redesign. They show that the economic significance of a resource depends on the infrastructures and relations through which it can re-enter activity. They also make visible a temporal question that conventional allocation analysis can obscure: whether an economic process preserves, depletes, restores, or reorganizes the capacities required for later processes. GRE will eventually extend this inheritance toward heterogeneous value conversion, recirculation, generative return, capture, dissipation, and transformation of generative capacity. Chapter 2 remains at the theoretical foundation. Circularity, regeneration, and generativity are connected problems whose differences are as important as their overlap.

## 2.28 Relational Value and Relational Goods

The preceding sections have reconstructed several traditions in which economic value appears through production, exchange, institutional organization, ecological dependence, care, commons governance, and circular or regenerative processes. The present section narrows the genealogy to theories in which the value of a good, practice, or activity depends partly on the relations through which it is constituted, realized, shared, interpreted, or sustained. Its role is to distinguish several intellectual lineages that are often grouped under a broad relational vocabulary but that identify different analytical objects. Its objective is to reconstruct five such objects: value within relations, relational goods, collective and community value, cultural and symbolic value, and forms of economic value that cannot be represented adequately through isolated possession alone. The discussion proceeds comparatively across moral philosophy, environmental valuation, economic sociology, relational-goods research, commons scholarship, cultural economics, and the anthropology of commodities. GR and GRE enter only in the closing synthesis as later frameworks that may connect these inherited problems without treating them as already equivalent.

The term *relational* requires particular discipline in this context. It can indicate

that a person's valuation is shaped by a relationship, that a good can be enjoyed only through interaction, that a good acquires meaning from a social relation, that a relation itself is treated as valuable, or that access to a shared institutional or ecological relation conditions the realization of other values. These claims differ in ontological strength and empirical content. Likewise, relational value, relational goods, public goods, commons, social capital, cultural value, and symbolic capital identify different theoretical problems. The genealogy becomes useful for GRE only if those differences remain visible.

### 2.28.1 Value within Relations

One route toward relational value begins in pluralist theories of valuation. Anderson argues that goods differ not only in the amount of value assigned to them but also in the modes through which they are appropriately valued and in the social relations through which their value is realized (E. Anderson 1993). Love, respect, friendship, citizenship, market use, and impersonal calculation do not simply represent different quantities on one common scale. They can involve different practical attitudes and different relationships among persons. The evaluative question therefore includes how an object or person is valued and which social relation the act of valuation expresses.

This approach matters economically because the same material transfer can realize different forms of value in different relationships. Payment to a contractor, a gift between friends, support within a household, compensation for care, and a public entitlement may involve similar monetary magnitudes while expressing different relations of obligation, authority, reciprocity, or membership. The economic significance of the transfer cannot always be reconstructed from price and quantity alone. Anderson's argument concerns normative modes of valuation rather than a general relational ontology, but it establishes a foundation for analyzing value as partly dependent on the social relation through which an object, service, or person is treated.

Zelizer develops a related problem within economic sociology. Her concept of *relational work* describes the practical activity through which people differentiate social relations, establish boundaries around them, match them with appropriate transactions, and select media of exchange that fit the relationship (Zelizer 2012). Monetary exchange therefore does not automatically erase intimacy, care, family relation, friendship, or professional obligation. Participants continually negotiate which transfers are appropriate, what they mean, and how they should be represented. Economic media are interpreted through social relations, while economic transactions can also reaffirm, contest, or transform those relations.

A different use of relational value appears in environmental ethics and sustainability research. Chan and colleagues introduce *relational values* to describe preferences, principles, and virtues associated with relationships among people and between people and nature, especially where the relevant concern is inadequately represented by a simple intrinsic-versus-instrumental dichotomy (Chan et al. 2016). Stewardship, care, identity, responsibility, belonging, and living well with others can matter because of the relationship itself and the commitments it carries. This environmental usage should remain conceptually distinct from relational goods in welfare or public-

choice theory. It concerns values associated with relationships and responsibilities, rather than necessarily a jointly consumed good produced through interaction.

The anthropology of exchange adds another perspective. Appadurai argues that value can be studied through the social and political organization of commodity circulation, drawing attention to the ways objects become desirable, exchangeable, restricted, or prestigious through historically situated regimes of exchange (Appadurai 1986). In this lineage, value is neither a timeless substance residing in the object nor merely an isolated subjective preference. It develops through relations among objects, persons, exchange situations, cultural classifications, and political conditions.

These approaches establish several distinct meanings of value within relations. A relation can shape the mode of valuation; the value can concern the relationship itself; a transaction can acquire meaning from the relation in which it occurs; and an object's value can change through its social trajectory. The common inheritance is analytical rather than doctrinal: value may require reconstruction of relations and practices that are invisible when valuation is represented only as an attribute attached to an isolated object or individual preference.

### 2.28.2 Relational Goods

The concept of *relational goods* gives this problem a more specific form. Uhlaner's analysis of political participation introduces relational goods into rational-choice reasoning as objectives whose value depends on interaction with, or identification with, other persons (Uhlaner 1989). Participation may therefore generate benefits that are conditional on the participation or presence of others. This changes the standard free-rider problem because an individual's payoff can partly arise from acting with particular others rather than solely from consuming the final public outcome.

Uhlaner's formulation is important precisely because it remains compatible with an individual-choice framework. Relational goods enter the individual's payoff structure, but their realization depends on social interaction or shared identity. This distinguishes them from ordinary private goods that can be enjoyed independently and from standard public goods whose benefits are available impersonally once provided. A political meeting, common celebration, collective action, or shared activity can matter because the participant values being involved with others in a particular way.

Gui develops the economic analysis further by treating interpersonal encounters as productive processes (Gui 2000). An encounter can generate ordinary outputs, such as information or service delivery, while simultaneously producing relational goods through communication, recognition, affect, trust, or the quality of interaction. Gui also introduces the idea of *relational assets*: relation-specific conditions such as mutual knowledge, familiarity, or social climate that affect the quality of later encounters and can themselves be strengthened or depleted through interaction. The economic process therefore has a recursive interpersonal dimension. Today's encounter can alter the relational conditions of tomorrow's encounter.

This formulation gives relational goods a temporal structure. Their production and consumption can occur together; their quality can depend on the participation of several actors, and previous interactions can affect later productive possibilities. A workplace, school, cooperative, neighborhood, or service relation can consequently

have economic characteristics that are poorly represented when interaction is modeled only as a vehicle for transferring independently produced goods between pre-formed individuals.

Donati reconstructs a stronger relational-sociological interpretation and explicitly contrasts it with rational-choice accounts (Donati 2019). Both approaches recognize goods that can be enjoyed only through sharing with others, but they differ over what the good fundamentally is. A rational-choice formulation can represent relational goods as benefits individuals obtain from shared interaction. Donati instead treats some relational goods as emergent properties of the relationship itself, generated through reciprocal orientations among participants. This is a stronger ontological claim and should not be silently imported into every economic use of the term.

The relational-goods literature therefore contains an internal disagreement that is important for Chapter 2. One can recognize interaction-dependent benefits without treating relations as emergent entities with their own causal properties. Conversely, a relational-sociological theory may claim that the relation itself becomes a real social good irreducible to the aggregation of individual utilities. GR can later engage this disagreement, but the genealogy should preserve it.

Several neighboring concepts should also remain separate. A relational good is not automatically a public good; Uhlener's formulation often depends on identifiable co-participants rather than anonymous non-rival consumption. It is not identical with social capital, which usually refers to resources available through networks, obligations, trust, or institutionalized relations. It is not equivalent to cooperation, since actors can cooperate instrumentally without valuing the relation itself. The distinctive issue is whether some valuable output or experience exists only through a particular configuration of participation and relation.

### 2.28.3 Collective and Community Value

The relational-goods literature leads toward a broader question concerning value that exists at collective or community scales. Collective value need not imply a mysterious value possessed by a group independently of its members. It can arise because some valued conditions depend on shared institutions, common practices, reciprocal expectations, collective memory, public spaces, infrastructures, ecological relations, or capacities for coordinated action. Their significance is partly located in the pattern of relation through which persons can participate in them.

The commons tradition provides one established route into this problem. Ostrom's analysis of common-pool resources shows that collective governance can generate capacities that cannot be understood by examining resource units or isolated appropriators alone (Ostrom 1990). Monitoring, rule-making, sanctioning, conflict resolution, trust, and recognized boundaries can make continued access and sustainable use possible. The value realized by participants consequently depends partly on an institutional relation among users and between users and the resource. This does not make the resource itself a relational good in the narrower sense. The point is that collective institutional capacity can become a condition for realizing individual and shared values.

Gift and reciprocity traditions reveal another form of collective value. Mauss an-

alyzes exchange systems in which giving, receiving, and reciprocating participate simultaneously in legal, moral, religious, political, and status relations (Mauss 1990). Polanyi later distinguishes reciprocity, redistribution, and market exchange as different instituted patterns through which economic activity is organized (Polanyi 1957). These traditions show that value circulation can participate in the reproduction of membership and social relation. What is sustained is not only a sequence of transfers but also a pattern of obligation, recognition, alliance, and collective continuity.

Collective and community value can therefore include a capacity to continue acting together. A neighborhood association, scientific community, cooperative, language community, commons institution, or cultural association may generate value through shared rules, accumulated knowledge, mutual expectations, common infrastructures, and opportunities for participation. Some of these benefits can be assigned to individuals; others concern the continued existence and quality of the collective relation that makes future participation possible.

The concept remains normatively ambiguous. A cohesive community can exclude outsiders, enforce oppressive roles, concentrate authority, or stabilize unjust practices. Collective persistence is therefore not equivalent to collective value in a normative sense, and collective value for insiders can coexist with costs imposed on non-members. The question of who constitutes the relevant community, who participates in defining its goods, and whose burdens are externalized remains essential.

For later GRE, the useful inheritance is the idea that some economic values depend on collective capacities and shared relational conditions rather than on independently possessed objects alone. The stronger claims concerning the generation, return, distribution, and justice of collective value belong to later parts of the book.

#### 2.28.4 Cultural and Symbolic Value

Cultural and symbolic approaches extend the relational problem from interpersonal interaction toward classification, distinction, representation, and historically shared meaning. Bourdieu's analysis of taste demonstrates that judgments of cultural worth are structured through social position, education, habitus, distinction, and struggles over legitimate culture (Bourdieu 1984). Cultural goods therefore operate within relations of classification and social difference. Their significance cannot be reconstructed solely from production cost or market price because practices of recognition and distinction participate in making particular objects, styles, credentials, or tastes socially consequential.

Bourdieu's broader vocabulary of symbolic power also shows that classifications can have effects because they are socially recognized. Symbolic value is consequently relational in a specific sense: prestige, legitimacy, distinction, and authorized classification depend on recognition within structured social fields. This does not mean that symbolic capital is simply another name for relational value. Symbolic capital refers to resources and forms of recognized legitimacy operating within relations of power and classification; the broader relational-value problem includes many forms of value without this specific field-theoretic structure.

Cultural economics develops another lineage. Throsby distinguishes economic value from cultural value and treats cultural value as multidimensional, potentially



involving aesthetic, symbolic, spiritual, historical, social, and authenticity-related dimensions that do not collapse into a single monetary measure (Throsby 2001). His concept of cultural capital further directs attention to assets that embody cultural value and can transmit cultural benefits across time. A heritage site, artistic practice, language, archive, or cultural institution can consequently possess economic effects while also sustaining forms of significance that monetary valuation represents only partially.

The anthropology of commodities adds historical mobility to this picture. Kopytoff argues that commoditization is itself a cultural and cognitive process: societies classify which things may become commodities, which should remain outside market exchange, and when an object can move from one status to another (Kopytoff 1986). An heirloom, sacred object, artwork, document, body part, or public asset may therefore acquire different economic and moral statuses during its social biography. The object remains materially continuous while its admissible relations of ownership, exchange, use, and valuation change.

Appadurai similarly treats commodity status and value as situated within social trajectories and political regimes of exchange (Appadurai 1986). Together with Zelizer's relational work, these approaches undermine the assumption that a transaction medium carries one fixed meaning across contexts. Price can be analytically important while remaining insufficient to describe the cultural and relational transformation through which something becomes saleable, giftable, sacred, prestigious, publicly protected, or excluded from exchange.

The lineage therefore separates several dimensions that are frequently conflated. Cultural value concerns forms of significance constituted through cultural practices and histories. Symbolic value concerns recognition, classification, prestige, or legitimacy within structured social relations. Commodity status concerns the social authorization of exchangeability. Market price concerns the terms of a particular exchange. Their interaction is empirically important, but none can be substituted automatically for the others.

### 2.28.5 Economic Value beyond Isolated Possession

The preceding traditions collectively challenge a representation of economic value in which every relevant good appears as an object possessed by an isolated individual. Ownership and individual possession remain important economic institutions, especially where exclusion, transfer rights, collateral, control, liability, or inheritance matter. The point of the relational literature is narrower: some economically relevant values are realized through access, participation, recognition, shared use, institutional membership, reciprocal relation, cultural meaning, or continued connection rather than through possession alone.

The capability approach offers one parallel foundation. Sen's distinction between resources and capabilities shows that possession of a resource does not determine the substantive opportunity it affords (Sen 1999). Conversion depends on personal, social, and environmental conditions. A library, transport system, digital infrastructure, public space, school, or health system can therefore matter economically because it enters a relation of access and capability formation. Individual ownership

of the underlying asset is not required for the participant to realize significant value from it.

Shared-resource theory offers a second route. Frischmann treats infrastructures as shared inputs whose social value can arise through heterogeneous downstream activities that cannot always be predicted or priced in advance (Frischmann 2012). The value of a road, communications network, knowledge resource, standard, or research infrastructure may therefore depend on the field of activity it enables for many users. Its economic significance can exceed the sum of direct payments collected for access, especially where openness allows unanticipated complementary uses to emerge.

Relational goods provide a third route. In Gui's account, an encounter can produce a good whose realization is inseparable from participation in the encounter itself (Gui 2000). The relevant value cannot be stored and transferred like an ordinary asset while preserving all of its properties. Friendship, collegiality, mutual recognition, civic participation, or a trusting service relation may rely on continuing relations that are altered when one party withdraws or when the institutional setting changes.

Cultural and symbolic theories add still another route. The value of a cultural object may depend on provenance, collective memory, authenticity, recognition, or the institution within which it is preserved. A symbolic status can depend on continuing social acknowledgment. A commons can depend on a governance relation that maintains access and ecological capacity. In each case, a possession-based metric records only one dimension of the economic situation.

This wider view does not require the conclusion that all value is relational or that property and individual preference cease to matter. It instead enlarges the set of economically relevant relations. Some values are attached principally to objects or states; some depend on what a person can do with resources; some emerge through interaction; some reside in shared institutional capacity; some are sustained through cultural recognition; and some depend on ecological or infrastructural relations that no individual participant can reproduce alone.

The theoretical inheritance for GRE can therefore be stated cautiously. Existing literatures already provide multiple ways to understand value as relation-dependent, jointly realized, culturally constituted, institutionally enabled, or symbolically recognized. They also reveal that these forms of value may be vulnerable to disruption when the sustaining relation disappears. Later GRE can investigate how such values are generated, maintained, transformed, circulated, captured, returned, or dissipated across changing relational systems. Chapter 2 does not yet supply that generative theory. Its contribution is to establish that an economics restricted to isolated possession would exclude several well-developed traditions in which relations participate directly in the constitution or realization of economically significant value.

This foundation also prepares the normative problem that follows. Once some valuable goods and capacities depend on relations, institutions, shared meanings, and conditions of participation, questions of justice cannot be exhausted by asking who possesses how much of a distributable object. They also concern the procedures, relations, recognition structures, and generative conditions through which valuable possibilities become available or unavailable in the first place.

## 2.29 Justice Theory and Generative Justice

The preceding sections have reconstructed traditions in which value, capability, care, commons governance, ecological capacity, regeneration, and relational goods expand the objects that economic analysis may need to evaluate. The present section turns from the objects of value to the standards by which their distribution, production, circulation, and institutional organization may be judged. Its role is to reconstruct several major traditions of justice theory that later make a generative-relational account of justice possible without treating that later account as their necessary conclusion. Its objective is to distinguish distributive, procedural, relational, and generative questions, and then to clarify why circulation, return, and the continued capacity to generate value introduce an additional normative problem. The method is genealogical and comparative: Rawlsian, capability, entitlement, procedural, recognition, relational-egalitarian, and generative-justice approaches are allowed to retain their disagreements. GR and GRE enter only at the end as later frameworks that may place these inherited questions into a common temporal and relational analysis.

The distinctions are important because the word *justice* can refer to different objects of evaluation. A distribution can be criticized because persons receive unequal or inadequate shares. A decision can be criticized because the procedure is arbitrary or exclusionary. A social order can be criticized because persons stand in relations of domination, stigma, dependency, or unequal authority even when some material inequalities have been reduced. A historical process can also be questioned because it extracts value, depletes the capacities that generated it, or closes the conditions under which affected persons and communities could participate in future generation. These dimensions can interact, but none can be inferred automatically from another. The genealogy of justice theory is therefore most useful when it identifies several evaluative questions rather than compressing them into one master criterion.

### 2.29.1 Distributive Justice

Modern theories of distributive justice ask how benefits, burdens, opportunities, rights, resources, or other socially significant goods should be distributed among persons. Rawls gives one of the most influential formulations by treating the basic structure of society as a primary subject of justice and asking which principles free and equal persons would select under fair conditions of choice (Rawls 1999). His account does not simply prescribe equality of final holdings. Equal basic liberties, fair equality of opportunity, and the difference principle perform different roles, and the distributive question is located within the institutional organization of social cooperation rather than reduced to a direct division of an already fixed stock.

Rawls is especially important for the present genealogy because the object of distribution is partly institutional. The basic structure shapes life prospects through property regimes, legal rules, political institutions, educational opportunities, labor markets, and other arrangements. Distribution therefore concerns more than the final pattern visible at one moment. Institutional arrangements help produce the positions and expectations whose distribution is later observed. Even so, Rawlsian jus-

tice remains distinguishable from the stronger generative problem developed later in this section: the fact that institutions shape prospects does not by itself amount to a theory of how the capacities and relations that generate future value should be reproduced, returned to, or transformed.

Sen changes the evaluative space. His capability approach argues that equality or inequality should not be assessed only through resources, primary goods, income, or subjective utility because persons differ in their ability to convert means into valuable beings and doings (Sen 1992; Sen 1999). What matters includes the substantive freedoms people actually possess. Two persons can hold the same resource bundle while facing radically different opportunities because of disability, social norms, public infrastructure, care responsibilities, environmental conditions, or other conversion factors. Distributive justice consequently becomes partly a question about the distribution of effective capability rather than only the distribution of commodities.

The capability approach also complicates the relation between distribution and generation. Education, health, public infrastructure, social recognition, political participation, and care can be valued as present achievements, but they can also enlarge or diminish what people will later be able to do. Sen's framework does not thereby become a theory of generative justice, yet it provides an important foundation for asking whether justice concerns the distribution of future capability as well as present goods. This is one reason GRE should preserve the capability tradition as a distinct inheritance rather than absorb it into a generalized language of value.

Nozick provides a sharply different challenge to distributive reasoning. His entitlement theory argues that justice in holdings is historical: whether a holding is just depends on processes of acquisition, transfer, and, where injustice has occurred, rectification, rather than on whether the resulting distribution conforms to a preferred end-state pattern (Nozick 1974). Whatever one concludes about Nozick's substantive principles, the methodological contrast is significant. It demonstrates that identical present distributions can be evaluated differently when their histories differ. A theory of justice may therefore need to ask not only *what* persons possess but *how* the present arrangement came about.

Rawls, Sen, and Nozick should not be synthesized into one distributive doctrine. Rawls evaluates a fair basic structure; Sen emphasizes capabilities, realizations, and comparative removal of injustice; Nozick makes legitimate historical entitlement central. Their disagreement establishes a broader foundation: the currency of justice, the institutional site of justice, and the relevance of historical process are themselves contested. Later generative-relational analysis can inherit this plurality without deciding in advance that one evaluative space exhausts the others.

### 2.29.2 Procedural Justice

Procedural justice shifts attention from the pattern of outcomes to the process through which decisions, allocations, classifications, and authoritative judgments are made. Rawls distinguishes several forms of procedural justice according to the relation between an independent criterion of a correct outcome and the procedure used to reach it (Rawls 1999). The distinction makes clear that a just procedure is not merely a technically efficient route to a result. Procedures can themselves be part of

what justice evaluates.

This insight becomes particularly important where no uncontested independent criterion determines the unique correct outcome. Elections, adjudication, collective bargaining, regulatory decision making, research assessment, and participatory governance often require rules governing voice, representation, evidence, contestation, revision, and authority. A procedure can allocate standing and agenda-setting power before any final distribution is known. The design of decision processes can therefore alter which interests become visible, which forms of knowledge count, and which alternatives remain available for consideration.

Empirical procedural-justice research adds another dimension. Tyler's work on legal authority shows that people's assessments of fairness and legitimacy depend substantially on how authorities exercise power, including opportunities for voice, neutrality, respectful treatment, and trustworthy decision making, rather than solely on whether individuals receive preferred outcomes (Tyler 2006). This does not convert perceived procedural fairness into a complete moral theory. A procedure may be experienced as legitimate while operating within unjust background institutions. The empirical literature instead shows that procedures have independent social effects: they shape legitimacy, compliance, trust, and willingness to cooperate.

Procedural justice also introduces a temporal problem. Procedures are not only devices that produce decisions; repeated procedures can train participants, distribute political competence, create or erode trust, stabilize roles, and establish expectations about who may speak and who must listen. A participatory institution may generate capacities for later collective action, while an opaque or humiliating process can diminish them. This observation prepares a later generative question, but the distinction must remain clear: procedural justice concerns the fairness and legitimacy of decision processes; generative justice asks additionally what those processes do to the capacities and relations from which future action and value creation become possible.

Thus outcome and procedure remain analytically distinct. A favorable outcome can be reached through an exclusionary procedure, while a fair procedure can yield an outcome that some participants regard as substantively inadequate. Later GR/GRE should retain this distinction rather than treating procedural participation as sufficient evidence of distributive or relational justice.

### 2.29.3 Relational Justice

A third family of theories argues that justice cannot be reduced to distributive shares or procedural form because the relations in which persons stand to one another are themselves normatively significant. Young's critique of the distributive paradigm emphasizes domination, oppression, decision-making power, cultural representation, institutional position, and group difference as justice-relevant phenomena that cannot always be represented as quantities of goods allocated among already independent individuals (Young 1990). The question becomes partly whether social structures place some persons under the arbitrary power, silencing, marginalization, or normative authority of others.

Anderson develops a related account of democratic equality. Her critique of



luck-egalitarian approaches redirects attention from compensating persons for undeserved disadvantages toward creating a community of equals in which people relate without oppression, hierarchy, stigma, or second-class standing (E. S. Anderson 1999). Scheffler similarly identifies an important strand of egalitarian thought in the ideal of social relations among persons who regard one another as equals rather than in equal distribution alone (Scheffler 2003). Relational equality consequently does not make distribution irrelevant. Material inequalities matter partly because they can produce or express relations of domination, dependency, subordination, or unequal status.

Recognition theory introduces another route to relational justice. Honneth analyzes injuries of misrecognition through their effects on socially mediated self-relation and moral experience (Honneth 1995). Fraser, by contrast, resists reducing justice to recognition and argues for an integrated analysis of redistribution and recognition oriented toward parity of participation; her exchange with Honneth makes the disagreement explicit (Fraser and Honneth 2003). Material deprivation and status subordination can reinforce one another, but they remain analytically distinguishable. A person can receive resources while remaining institutionally stigmatized, or enjoy cultural recognition while lacking the material conditions for effective participation.

Relational justice therefore enlarges the evaluative object from *what people have* to *how people stand in relation to one another*. Authority, dependence, vulnerability, recognition, participation, and the capacity to contest decisions become relevant. Yet the relational perspective should not be treated as automatically superior to distributive analysis. Relations are partly sustained through resources, law, organizational position, infrastructure, and access to capabilities. The distributive and relational dimensions can be mutually constitutive without being reducible to one another.

This distinction also matters for GR. A relation can be causally productive while normatively objectionable. Exploitative labor relations, exclusionary communities, highly coordinated authoritarian organizations, and discriminatory institutions can generate trust among insiders, capacities, identities, or economic output. Generativity is therefore not itself a criterion of justice. A later generative-relational theory must specify which forms of generation, for whom, under which relations, and with what effects on the possibility of future participation and contestation.

#### 2.29.4 Generative Justice

The phrase *generative justice* already names an established theoretical and practical tradition and should not be presented as terminology invented by GR or GRE. Eglash and Garvey's early formulation connected bottom-up social organization, sustainability, egalitarianism, and dynamical ideas of self-organizing social ecologies (Eglash and Garvey 2014). Eglash subsequently developed a more explicit account organized around the generation, alienation, and circulation of value (Eglash 2016). This lineage provides one of the most direct predecessors for GRE's later concern with generative value and therefore requires explicit attribution as well as conceptual differentiation.

Eglash's framework begins from a critique of extractive arrangements in which value is separated from the human, ecological, or expressive sources that generate

it. Its normative alternative emphasizes unalienated value, participation by value generators in the benefits of generation, control over conditions of production, and self-sustaining paths through which value can circulate rather than being removed in ways that degrade the source of future generation (Eglash 2016). The framework therefore differs from a theory concerned only with redistribution after extraction has already occurred. It asks whether the social or ecological source remains capable of generating and whether those who participate in generation retain meaningful control and benefit.

This shift is important because it changes the temporal position at which justice is evaluated. Distribution commonly examines the allocation of goods or opportunities within an institutional order. Generative justice asks about the production process, the source of value, the continued capacities of generators, and the pathways through which generated value moves. A transfer that improves the final distribution can coexist with an extractive structure that repeatedly recreates deprivation. Conversely, a system that returns material, knowledge, authority, capability, or ecological resources to the sites from which value is generated may alter the conditions producing future distributions.

Later work on computational reparations extends this framework through the idea of unalienated circular value flow and argues that reparative transformation should support value generators in controlling production conditions, protect generated value from extraction, and circulate value in ways that benefit the human and non-human communities involved in generation (Eglash, Robinson, et al. 2024). This is a substantive research programme, not merely a metaphor for fairness. It links justice to institutional design, technology, labor, ecology, community governance, and the reproduction of generative capacity.

GR/GRE inherits this tradition but should not simply rename it. Eglash's generative justice provides a normative and design-oriented framework centered especially on labor, ecological, and expressive/social value, unalienation, bottom-up organization, and circular return. Later GRE may investigate a broader range of heterogeneous value forms, relations among value domains, conversions that are only partially commensurable, and changes in the conditions through which new relations and capacities become possible. Those extensions require argument; they cannot be claimed as implicit in the predecessor literature. Chapter 2 therefore records generative justice as an existing lineage that makes the later GRE problem intelligible while preserving the boundary between inheritance and reconstruction.

### **2.29.5 Circulation, Return, and Generative Value**

The final foundation concerns the relation between justice and the movement of value after it has been generated. Eglash's formulation is especially important because it treats circulation back toward value-generating sources as part of justice rather than as an optional distribution undertaken after production (Eglash 2016; Eglash, Robinson, et al. 2024). Ecological nutrients returned to soils, revenues and productive authority retained by workers or communities, knowledge circulated among participants, and social resources reinvested in the relations that generated them illustrate different kinds of return. These examples should not be collapsed into one

homogeneous substance called value. They indicate a family of problems concerning whether generative sources are reproduced, strengthened, depleted, or alienated through subsequent circulation.

This perspective connects with several lineages already reconstructed in this chapter. Marxian circulation and reproduction show that production cannot be separated from the conditions of the next production cycle. Feminist social-reproduction theory shows that laboring capacities depend on care and reproductive activity that can be externalized from formal economic accounting. Ecological economics shows that production depends on regenerative and assimilative capacities that extraction can degrade. Commons theory shows that shared resources persist only where governance and maintenance reproduce conditions of access and cooperation. Capability theory shows that resources matter through the opportunities they help people realize. None of these traditions is equivalent to generative justice, but together they make it possible to see return as more than monetary redistribution.

For GRE, *generative value* should therefore be approached cautiously at this foundational stage. Eglash's prior work establishes a clear precedent for value that remains connected to and circulates through its generative sources. GRE's later task is to investigate how heterogeneous forms of value are generated, converted, circulated, returned, captured, dissipated, and regenerated across relational systems. The relevant return may be material, ecological, epistemic, institutional, capability-forming, cultural, or relational. Because these forms can be only partially commensurable, return cannot be assumed to mean restoration of an equivalent quantity on one common scale.

This also distinguishes *return* from several neighboring concepts. Return is not identical to compensation, because compensation can occur without restoring generative capacity. It is not identical to redistribution, because redistribution can move goods among recipients without altering the relation between value generation and extraction. It is not identical to reciprocity, because return can occur through institutional or ecological pathways without a dyadic exchange of benefits. And it is not identical to circularity, because a circular flow can reproduce an unjust or degrading relation. The normative question concerns what is returned, to which generative source or community, through which institutional pathway, and whether the return sustains or enlarges future capacities without imposing unjust burdens elsewhere.

A generative-relational perspective therefore adds a temporal question to established justice theory: how do present arrangements distribute the *capacity to participate in the generation of future possibilities*? This question should remain provisional here. It points toward later GRE analyses of capacity generation, option-space formation, generative foreclosure, intergenerational generativity, and the justice of relation formation and transformation. Chapter 2 does not yet provide those theories. Its task is to establish that distributive, procedural, relational, capability, reproductive, ecological, and Eglashian generative-justice traditions together supply a sufficiently rich intellectual foundation for asking them.

The genealogy yields a final set of distinctions that later GRE must preserve. Distributive justice evaluates shares, resources, capabilities, or holdings; procedural justice evaluates decision processes and participation; relational justice evaluates standing, domination, recognition, and the quality of social relations; generative justice, in

Eglash's established usage, evaluates value generation, alienation, control of production conditions, and circulatory return; and later GR/GRE may ask how the relations and capacities from which future possibilities emerge are themselves generated and distributed. These objects interact, but no one of them provides a complete substitute for the others. Justice in a generative-relational economy will therefore require attention both to what people receive and to the processes, relations, and future-generating conditions through which economic life remains possible.

## 2.30 Systems Theory and Cybernetic Traditions

The preceding sections have reconstructed economic and social theories in which institutions, relations, capabilities, reproduction, ecological capacity, circularity, value, and justice become historically organized rather than appearing as isolated attributes of already constituted actors. The present section turns to a different intellectual lineage: the twentieth-century development of systems theory and cybernetics. Its role is to establish the conceptual resources through which wholes, environments, feedback, regulation, self-organization, and adaptation became objects of systematic analysis across biology, engineering, organization theory, and the social sciences. Its objective is not to treat these traditions as a single systems doctrine, but to distinguish several problems that were often connected historically while remaining analytically different. The section therefore moves from the system–environment distinction to feedback, regulation and control, self-organization, and open or adaptive systems. Its method is genealogical and comparative. General systems theory, classical cybernetics, management cybernetics, autopoiesis, nonequilibrium self-organization, and sociological systems theory are reconstructed as partially overlapping lineages whose differences remain important for later GR and GRE.

A systems vocabulary can easily become so general that it ceases to discriminate among mechanisms. Almost any object can be called a system once elements, relations, and a boundary have been specified. Feedback can describe a causal loop without implying successful regulation. Regulation can preserve selected variables without implying centralized command. Self-organization can refer to internally generated reorganization, emergent pattern formation, or self-production, depending on the theoretical tradition. Openness can refer to exchange of matter, energy, information, or other resources with an environment, while organizational closure in autopoietic theory concerns a different property altogether. The value of the systems and cybernetic traditions therefore lies less in one universal vocabulary than in the set of distinctions they made available for studying organized persistence and change.

### 2.30.1 System and Environment

General systems theory gave the system itself a methodological status that differed from both atomistic decomposition and discipline-specific description. Von Bertalanffy argued that formally similar organizational problems could arise across otherwise heterogeneous domains and that scientific analysis therefore required concepts adequate to wholes, organized relations, and open systems rather than only isolated

components (Bertalanffy 1968). His programme did not require that organisms, organizations, physical systems, and societies be materially identical. Its claim was that certain structural or organizational forms could be studied at a level abstract enough to permit comparison across domains.

The distinction between a system and its environment is indispensable to this move. A system becomes analytically identifiable only through some specification of what belongs to the focal organization, what remains outside it, and which exchanges or perturbations cross the boundary. In von Bertalanffy's treatment of living organisms, the importance of the environment is especially clear because living systems are open: they maintain themselves through continuing inflows and outflows rather than through isolation from surrounding conditions (Bertalanffy 1968). A relatively persistent organization can therefore coexist with continuing turnover of material components. Persistence of system organization is not identical to persistence of every element composing it.

The system–environment distinction is nevertheless not a neutral act of description. Different research questions can produce different boundaries around the same empirical domain. A household may be treated as a unit in one model, while relations among household members become the focal system in another. A firm can be analyzed as an organization interacting with markets, as a set of internal regulatory processes, or as one node within a wider production network. Systems analysis consequently requires explicit boundary specification rather than assuming that the relevant system is naturally given in advance.

Later sociological systems theory gives the system–environment distinction a stronger theoretical role. Luhmann makes the distinction central to a theory in which social systems are constituted through communication and differentiated from environments that remain more complex than the systems themselves (Luhmann 1995). This is not simply von Bertalanffy's open-system biology transferred to sociology. Luhmann's social systems are organized through a distinctive theory of communication, self-reference, and operational differentiation. The comparison is therefore useful precisely because it demonstrates how the same vocabulary of system and environment can carry different ontological and explanatory commitments.

The systems lineage leaves later GR with a basic but limited inheritance. Relations can be studied within organized wholes, and any such analysis must specify a boundary and an environment. Yet the identification of a system does not establish that the boundary is permanent, ontologically ultimate, or causally exogenous. A later generative-relational analysis can therefore inherit system–environment distinctions while asking how boundaries, memberships, and relevant environments themselves become formed, contested, and transformed. That stronger question should not be attributed retrospectively to general systems theory as a whole.

### 2.30.2 Feedback

Cybernetics made feedback one of the central concepts for understanding organized behavior across machines and organisms. Rosenblueth, Wiener, and Bigelow had already analyzed behavior through relations between inputs, outputs, and purposeful activity before Wiener's *Cybernetics* consolidated control and communication into a



wider interdisciplinary programme (Rosenblueth et al. 1943; Wiener 1948). Feedback shifts explanation away from a strictly one-directional causal sequence. An output can alter conditions that become relevant to subsequent inputs, so the consequences of action can enter the process that generates later action.

This recursive structure does not by itself determine what the loop will do. Negative feedback is commonly associated with error correction or stabilization because deviations from a reference condition can produce responses that counteract the deviation. Positive feedback can amplify an initial difference because the consequence of a process strengthens the conditions that produce further change in the same direction. The same system can also contain several loops with different delays, gains, timescales, and points of intervention. The presence of feedback therefore does not entail homeostasis, stability, or self-correction.

Wiener's cybernetics connected feedback to communication and information. A regulator must in some way receive signals concerning relevant states or deviations and convert those signals into responses capable of affecting later system behavior (Wiener 1948). This connection helped make control problems comparable across servomechanisms, physiology, nervous systems, and other organized processes. Yet the analogy remains methodological rather than a demonstration that biological, mechanical, and social feedback possess the same meaning or mechanism.

Feedback also has a distinct significance for economic and social analysis. Expectations can alter behavior in ways that influence the conditions to which those expectations respond. Rules can change behavior, which changes the distribution of cases to which the rule is subsequently applied. Prices, investment, institutional legitimacy, network participation, and technological adoption can each enter reinforcing or counteracting loops. Such applications require mechanism-specific analysis: naming a loop does not explain the social relations, delays, information channels, power structures, or institutional conditions through which the loop operates.

For later GR, the cybernetic legacy is therefore recursive rather than teleological. Consequences can re-enter the conditions of subsequent generation, but a feedback loop is not yet a generative theory. Feedback may reproduce a previously specified target, amplify deviation, or destabilize an existing arrangement without generating new categories, relations, capacities, or rules. GR can inherit the causal importance of recursive effects while retaining a separate question concerning when recursion changes the architecture through which later feedback itself becomes possible.

### 2.30.3 Regulation and Control

Regulation gives feedback an evaluative or functional orientation by specifying variables, ranges, or conditions whose maintenance matters to the system under study. Ashby's cybernetics is particularly important because it formalizes regulation through the relation among disturbances, regulators, outcomes, and variety (Ashby 1956). His law of requisite variety expresses a limit on regulation: a regulator cannot reliably compensate for a range of disturbances if its own available responses are insufficiently differentiated for the task. Regulation is therefore constrained by informational and behavioral variety rather than secured merely by the existence of an authority or control center.

This insight should not be translated too quickly into political language. In cybernetics, *control* can refer to the capacity of a mechanism to keep selected variables within an acceptable range despite disturbance. It does not necessarily mean centralized domination, coercion, or hierarchical command. A distributed set of local processes can regulate a system, and centralized authority can fail to regulate one if it lacks adequate information, response variety, or temporal responsiveness. Political power and cybernetic control can interact, but they remain different concepts.

Ashby's framework also clarifies why regulation is selective. Every regulator implicitly or explicitly privileges some variables and some acceptable ranges. Maintaining temperature, liquidity, organizational viability, ecological stock, or inflation within a specified range are different regulatory projects because they define different essential variables and different disturbance structures. Successful regulation of one variable can also destabilize another. A regulatory analysis is therefore incomplete until it identifies what is being maintained, against which disturbances, by which mechanisms, and at whose cost.

Management cybernetics extends these problems to organizations. Beer's viable-system work treats organizations as recursively organized systems that must coordinate operations, manage internal complexity, respond to environments, and maintain viability across several levels of organization (Beer 1972). Its importance for the present genealogy lies in taking organizational complexity seriously rather than assuming that a single command center can directly control every relevant process. Viability requires differentiated functions, information channels, coordination, and sufficient regulatory variety.

Regulation and control nevertheless remain narrower than governance in the sense used later in GRE. Regulation asks whether selected variables can be maintained or guided under disturbance. Governance also raises questions concerning who defines the target, how legitimate authority is constituted, which actors bear regulatory burdens, which possibilities are excluded, and whether the regulated order should continue to exist. A system can be cybernetically well regulated and normatively objectionable. Conversely, a legitimate governance arrangement can face severe regulatory limits. This distinction will matter later when GRE studies the generation and transformation of governance relations rather than equating governance with system stabilization.

#### 2.30.4 Self-Organization

Self-organization introduces a different problem. Regulation generally presupposes some relevant organization whose variables are to be maintained or controlled. Self-organization asks how organized pattern can arise or change without being fully specified by an external organizer. Ashby's 1947 paper is an early cybernetic formulation of this problem: a determinate dynamic system can nevertheless undergo internally induced changes of organization and behavior (Ashby 1947). The significance of the argument lies in separating determinacy from a permanently fixed organization. A system can follow determinate dynamics while its internal configuration changes in ways that alter subsequent behavior.

Von Foerster later made self-organization and the role of the observer central prob-

lems within cybernetics, including the relation between self-organizing systems and their environments (Foerster 2003). This lineage gradually shifted cybernetics from the observation and control of systems toward reflexive questions concerning observation, recursion, and the conditions through which organization is identified. The move is important because what counts as organization often depends on a description of relevant variables, scales, and regularities rather than appearing independently of every observational standpoint.

A different lineage develops through nonequilibrium thermodynamics. Nicolis and Prigogine analyze self-organization through dissipative structures and pattern formation in systems maintained away from equilibrium by flows of energy or matter (Nicolis and Prigogine 1977). Here self-organization concerns the emergence of macroscopic order through nonlinear physical processes and fluctuations under nonequilibrium conditions. This should not be identified with Ashby's cybernetic reorganization or with social self-organization merely because the same word is used. The mechanisms, state variables, and explanatory objects differ.

Autopoiesis introduces still another concept. Maturana and Varela characterize living organization through networks of processes that recursively produce the components involved in producing and maintaining that organization (Maturana and Varela 1980). Their emphasis on organizational closure should not be confused with thermodynamic isolation. A living system can exchange matter and energy with an environment while remaining operationally organized through processes that reproduce the network constituting the living unity. Autopoiesis is therefore neither simply feedback nor a synonym for spontaneous order.

The diversity of these traditions makes a broad equation between self-organization and desirable decentralization untenable. Self-organized patterns can be fragile, exclusionary, extractive, or destructive. They can arise under strong boundary conditions and external resource flows. They may preserve an organization, transform it, or produce a pattern with no normative significance at all. Self-organization consequently describes a family of generative mechanisms rather than an ethical endorsement of whatever emerges without centralized design.

For later GR, self-organization supplies an especially important precursor because it makes the production of organization itself an explanatory object. Yet GR will need a wider vocabulary when the generated outcomes include new subjects, social categories, institutions, relations, interpretive schemes, capacities, or rules of subsequent generation. Self-organization establishes that organization need not be imposed externally in finished form. It does not by itself establish a general theory of how heterogeneous social relations generate one another across history.

### 2.30.5 Open and Adaptive Systems

The final lineage concerns systems that persist through continuing interaction with changing environments. Von Bertalanffy's open-system perspective rejects the assumption that living organization can be understood adequately as a closed equilibrium system. Organisms maintain relatively stable organization through continuous exchange, transformation, and throughput (Bertalanffy 1968). Openness therefore concerns dependence on environmental flows as well as exposure to disturbance. A

system can remain recognizable precisely because it is continually exchanging components with what lies beyond its boundary.

Adaptation introduces an additional question: how does the system alter its states, responses, or organization in relation to changing conditions? Ashby's work on regulation makes adaptation intelligible partly through changes that maintain essential variables within viable ranges despite disturbances (Ashby 1956). Beer's management cybernetics similarly treats viability as requiring an organization capable of responding to environmental complexity rather than preserving one rigid internal state (Beer 1972). Neither framework implies that every adaptation is optimal. Persistence can result from satisficing adjustment, institutional protection, redundancy, learning, environmental modification, or the disappearance of alternatives.

Autopoietic theory again complicates the vocabulary. Maturana and Varela emphasize that living systems do not simply receive environmental instructions and reproduce them internally. Environmental perturbations occur in relation to a system whose organization constrains the transformations it can undergo (Maturana and Varela 1980). This differs from a model in which the environment directly specifies the system's internal state. Adaptation can therefore involve a history of structural change under continuing coupling rather than passive conformity to an external template.

The idea of an adaptive system should also be distinguished from the later theory of complex adaptive systems developed more fully in Section 61. Here the term serves a broader historical purpose: it identifies the systems and cybernetic move from static organization toward persistence through changing interactions, feedback, regulation, and reorganization. Complexity theory later adds population-level adaptation, distributed agents, nonlinear interaction, multiscale organization, and emergent macro-patterns in more specific ways. Keeping these genealogies separate prevents *adaptation* from becoming a generic synonym for any successful historical change.

Several limits of the systems vocabulary are now visible. A system can adapt by narrowing the options of some participants, shifting costs into its environment, excluding disturbances from measurement, or reorganizing itself in ways that preserve the system while degrading broader social or ecological conditions. Viability of the focal system is not equivalent to welfare, justice, sustainability, or desirable development. System boundaries can conceal externalized burdens, just as regulatory targets can privilege some variables over others. The ethical and political evaluation of adaptation therefore requires concepts that systems theory alone does not supply.

The intellectual inheritance for GR and GRE can now be stated precisely. Systems theory contributes organized wholes, boundaries, environments, openness, and multilevel dependence. Cybernetics contributes recursive causation, feedback, regulation, information-sensitive control, variety, and viability. Self-organization traditions make the production of organization itself analyzable, while autopoiesis makes self-production and organizational closure central theoretical problems. None of these traditions is equivalent to Generative Relational Theory. A later GR framework asks the stronger historical question of how systems, boundaries, actors, relations, regulatory criteria, and even the mechanisms of adaptation are themselves generated and transformed through relational processes.

This distinction also prepares the next scientific lineage. Systems and cybernetics make recursion, regulation, adaptation, and organized persistence intelligible, but they do not by themselves provide the full geometric and temporal vocabulary needed to analyze state spaces, trajectories, attractors, bifurcations, critical transitions, and explicitly time-dependent dynamics. Those resources belong to the dynamical-systems traditions considered next. Chapter 2 therefore treats systems theory and cybernetics as indispensable foundations for GRE's later formal work while preserving their historical specificity and their limits.

## 2.31 Dynamical Systems and Nonlinear Change

Systems theory and cybernetics established conceptual resources for feedback, regulation, self-organization, adaptation, and organized persistence. Dynamical-systems theory adds a more explicitly temporal and geometric vocabulary for describing how states evolve, how families of possible evolutions are organized, and how qualitative patterns of motion can change. The role of this section is to reconstruct that vocabulary before it is used later in GR and GRE. Its objective is to distinguish five analytical objects that are frequently compressed into a general language of “dynamics”: state spaces, trajectories, attractors, bifurcations and critical transitions, and explicitly time-dependent forms of evolution. The discussion proceeds from the representation of possible states to the organization of motion and then to transformations in the governing dynamics. Its method is formal and genealogical. Mathematical concepts are introduced at the level needed to clarify their intellectual contribution, while their transfer to economic and social analysis remains subject to ontological suspension and model-specific justification (Strogatz 2024; Hirsch et al. 2012).

The dynamical-systems tradition changes the unit of analysis in a consequential way. A single observation describes where a modeled system is at one time; a dynamical analysis studies the rule or family of rules through which states are related across time. Stability, recurrence, oscillation, convergence, divergence, and sensitivity thereby become properties of organized evolution rather than static attributes of isolated states. Nonlinearity further permits effects whose magnitude and direction depend on the current state, interaction structure, or parameter regime. Small differences can decay in one region of a state space and expand in another. Several long-run patterns can coexist. A gradual parameter change can reorganize the qualitative structure of possible trajectories. These possibilities make dynamical systems especially important to later relational and generative work, while the mathematical vocabulary itself does not establish that an economy or society possesses a single fixed state space or evolution law.

### 2.31.1 State Spaces

A dynamical model begins by specifying a space of possible states. The state is intended to contain the variables required, at the level of the model, to locate the system at a given time and to determine its subsequent evolution together with the governing rule. Depending on the problem, the state space may be a finite set, a Euclidean space, a manifold, or a higher-dimensional or functional space. The term *phase space* is of-



ten used when the state variables include quantities such as positions and momenta or, more generally, when the geometric organization of possible motion is central. Modern expositions of dynamical systems treat this move from individual equations to the geometry of the state space as foundational because equilibria, periodic orbits, invariant sets, basins, and bifurcations are all defined relative to a specified space of possible states (Hirsch et al. 2012; Strogatz 2024).

For a continuous-time autonomous system, a standard representation assigns a state  $x(t)$  in a state space  $X$  and specifies a vector field  $f$  that gives the instantaneous rate of change. Equation 2.1 states the generic form.

$$\dot{x}(t) = f(x(t)), \quad x(t) \in X. \quad (2.1)$$

Equation 2.1 is deliberately minimal. It says nothing by itself about the material composition of the modeled system, the observability of the state, or the adequacy of the chosen variables. Its analytical contribution is to separate two objects: the current state  $x(t)$  and the evolution rule  $f$ . Discrete-time systems make the same distinction through iterated maps, where a rule assigns a successor state to a current state. Continuous and discrete formulations can therefore support a shared qualitative vocabulary even though their mathematical behavior and available theorems differ in important respects.

State-space construction is already an act of theoretical specification. A model of population dynamics may use population sizes as state variables; a model of market adjustment may use prices and quantities; an epidemiological model may partition a population into compartments. Each representation determines which differences count as differences of state and which details are suppressed. If relevant historical information is omitted, two observations represented by the same modeled state may evolve differently because the state description is insufficient. The apparent failure can reflect memory, hidden variables, delayed effects, stochastic influences, or an inappropriate boundary around the modeled system. Dynamical-systems language therefore makes state specification explicit rather than eliminating the epistemic problem of choosing what belongs in the state.

This point matters strongly for economic and social inquiry. Many social descriptions use variables whose meaning depends on institutions, classifications, legal arrangements, or historical conventions. A variable such as “employment,” “capital,” “creditworthiness,” or “household” can remain numerically measurable while its constitutive relations change. A state space built from such variables can be useful without being historically invariant. The state-space concept contributes a disciplined question: which distinctions must be represented for the modeled evolution to be intelligible? It does not guarantee that one representation remains adequate across institutional transformation.

The geometric viewpoint also distinguishes a state space from the empirical world it represents. Coordinates are analytical choices; dimensions may summarize heterogeneous processes; distances can be meaningful in one model and arbitrary in another. Transformations of coordinates can preserve relevant dynamical structure when the representations are appropriately related, while coarse-graining can remove distinctions that matter to the evolution. Later GRE can use state-space meth-

ods to organize economic processes, but the passage from an observed economy to a mathematical state space requires explicit choices concerning entities, relations, scales, variables, and measurement.

The inheritance from this first strand is therefore precise. Dynamical-systems theory provides a language in which possibilities can be represented together rather than as disconnected observations. It makes the geometry of possible states available for analysis and prepares the study of paths through that geometry. GR can inherit this representational resource while retaining a further question concerning the historical generation of the variables, dimensions, boundaries, and distinctions from which a state space is constructed.

### 2.31.2 Trajectories

Once a state space and evolution rule have been specified, dynamical analysis turns from possible states to trajectories. A trajectory records the ordered states generated from an initial condition under the model's dynamics. In continuous time, a flow describes how states are carried through the state space as time varies; in discrete time, repeated application of a map generates an orbit. The collection of trajectories produces a phase portrait through which equilibria, cycles, separatrices, recurrent regions, and other qualitative structures can be studied without requiring a closed-form solution for every initial condition (Hirsch et al. 2012; Strogatz 2024).

The trajectory perspective introduces history in a mathematically specific sense. Two states that are close at one instant can have different pasts and, depending on the dynamics, different futures. Conversely, trajectories originating from distinct initial states can converge toward the same long-run behavior. The dynamical object of interest is consequently larger than a sequence of independent snapshots. Temporal ordering, direction of motion, rates of change, and the geometry of neighboring trajectories can all matter to explanation.

Stability provides one central way to compare trajectories. An equilibrium is stable when sufficiently small perturbations remain controlled in an appropriate sense; asymptotic stability additionally requires nearby trajectories to approach the equilibrium over time. Related concepts apply to periodic orbits and invariant sets. Stability is therefore a property of responses to perturbation within a specified model and neighborhood. It should be distinguished from persistence observed over a finite historical period. An institution can appear empirically persistent because disturbances have been weak, because stabilizing mechanisms operate, because alternatives are blocked, or because the variables used to represent institutional change are too coarse. Dynamical stability becomes an explanatory claim only after the relevant state space and perturbations have been specified.

Nonlinear dynamics makes the relation between initial conditions and later trajectories especially important. Lorenz's analysis of a deterministic nonlinear model of atmospheric convection demonstrated that bounded deterministic equations can generate nonperiodic trajectories with strong sensitivity to small differences in initial conditions (Lorenz 1963). The significance of this result extends beyond the specific meteorological model. Determinism in the evolution rule does not entail practical long-run predictability. A system can be governed by deterministic equations while

finite precision in observations or initial conditions sharply limits forecasting horizons.

Sensitivity should also be kept distinct from randomness. Chaotic dynamics can arise in deterministic systems, whereas stochastic dynamics introduce probabilistic elements into the evolution law or disturbances. Empirical time series can make these sources difficult to distinguish, especially under limited data and measurement error. For social and economic inquiry, the distinction cautions against treating irregular observed motion as sufficient evidence of either randomness or deterministic chaos. Identification requires more than visual resemblance to a complicated trajectory.

Trajectories also make path dependence easier to formulate with precision. In a fixed dynamical system, a current state that fully specifies the system can in principle contain the information needed for future evolution. Historical dependence may then appear through the state itself, through multiple basins reached from different initial conditions, through hysteresis, or through variables that encode accumulated effects. In many empirical settings, however, the researcher observes only a projection of a richer state. Apparent dependence on the path can therefore arise because relevant historical variables remain outside the observed state description. Dynamical-systems theory does not dissolve the concept of history; it forces the analyst to ask where history enters the formal representation.

For later GRE, the trajectory concept is valuable because economic processes frequently concern transitions rather than isolated outcomes: accumulation, institutional change, capability formation, technological diffusion, debt dynamics, ecological degradation, and reconstruction all unfold through ordered histories. Yet a social trajectory is not automatically equivalent to a trajectory generated by a fixed vector field. The formal vocabulary becomes informative when a model states what counts as the state, which rule links states over time, and which forms of perturbation or uncertainty are relevant. The later generative-relational programme inherits the analytical priority of histories while allowing the structures that generate those histories to become historical objects in their own right.

### 2.31.3 Attractors

Attractors organize the long-run behavior of families of trajectories. In broad terms, an attractor is an invariant dynamical object toward which a set of nearby trajectories approaches under the evolution of the system. Depending on the system, attractors can take the form of stable equilibria, periodic orbits, invariant curves, or more complicated sets. The associated *basin of attraction* identifies the initial conditions whose trajectories approach the attractor. This vocabulary gives a geometric representation of convergence without requiring every trajectory to become identical at each finite time (Strogatz 2024; Hirsch et al. 2012).

The distinction between an attractor and its basin is conceptually important. The attractor describes an asymptotic organization of motion; the basin describes the region of initial conditions connected to that organization under the specified dynamics. A system with several attractors can therefore display multistability: different initial conditions, perturbations, or histories can lead toward different long-run regimes

even when the governing equations and parameter values are the same. Basin boundaries then become significant because a perturbation that remains within one basin can have a qualitatively different long-run consequence from a perturbation that crosses into another.

The language of attraction can mislead when transferred into ordinary social language. A mathematical attractor need not represent a goal, preference, intention, welfare maximum, or normatively desirable state. Attraction is a property of trajectories under an evolution law. A poverty trap, ecological collapse, segregated configuration, or unstable political-economic arrangement could in principle possess attracting dynamics within a model. Conversely, a socially desirable condition may be dynamically fragile. Normative evaluation and dynamical attraction therefore belong to different analytical dimensions.

The Lorenz system supplied an especially influential illustration of complicated bounded dynamics. Lorenz showed that a low-dimensional deterministic nonlinear system could produce bounded, nonperiodic motion and extreme sensitivity to initial conditions (Lorenz 1963). Subsequent dynamical-systems work developed the geometric and topological analysis of chaotic invariant sets and strange attractors much further. The broader lesson is that long-run organization need not reduce to convergence toward a fixed point or simple periodic cycle. A bounded region of state space can sustain persistent aperiodic motion whose detailed trajectory remains difficult to forecast.

Attractor language has consequently traveled into ecology, economics, political analysis, and theories of social reproduction. Such travel can be analytically productive when the analogy is disciplined. To claim that an institutional order, trust relation, market regime, or pattern of inequality functions as an attractor requires more than observing persistence. The analyst needs some account of the relevant state variables, the mechanisms that move the system through the state space, the neighborhood from which return or convergence occurs, and the perturbations under consideration. Without those elements, “attractor” operates mainly as a metaphor for persistence or recurrence.

This distinction is especially relevant to GR and GRE because later chapters will use attractor-like reasoning to study self-reinforcing relational formations. The dynamical-systems lineage contributes a rigorous conceptual separation among current state, long-run invariant organization, basin structure, perturbation, and return. GR can then ask a stronger generative question: how are the attractor, its basin, and the dynamics that create the basin historically produced or modified? A social process may alter the very relations that previously stabilized it, creating new modes of reproduction or removing old ones. That problem extends the inherited dynamical vocabulary without being contained in the mathematical definition of an attractor itself.

Attractors also provide a useful bridge between persistence and contingency. A system can display strong local persistence once it enters a basin while remaining contingent with respect to the historical events that brought it there. Conversely, a basin can shrink or disappear as parameters change. This combination helps explain why dynamical-systems theory became important to later thinking about lock-in, resilience, regime shifts, and critical transitions. Those applications depend, however,

on the next distinction: qualitative change in the organization of trajectories cannot be inferred merely from movement within an unchanged phase portrait.

### 2.31.4 Bifurcation and Critical Transition

Bifurcation theory studies qualitative changes in dynamical behavior as parameters vary. A parameterized family of dynamical systems can preserve the same broad phase portrait over one range of parameter values and then undergo a structural change at a critical value. Equilibria can appear or disappear, stability can change, periodic motion can emerge, or invariant structures can reorganize. The principal contribution of bifurcation theory is therefore to distinguish motion within a dynamical regime from changes in the regime's qualitative organization (Kuznetsov 2023; Strogatz 2024).

Classical local bifurcations illustrate several different mechanisms. In a saddle-node bifurcation, equilibria can be created or annihilated in pairs. A transcritical bifurcation can exchange stability between intersecting equilibrium branches. Pitchfork bifurcations arise in systems with suitable symmetry and reorganize equilibria through symmetry-breaking or its reverse. A Hopf bifurcation can convert the stability of an equilibrium into nearby oscillatory behavior through the emergence or disappearance of a periodic orbit. These names classify local mathematical structures; they do not supply substantive explanations for the empirical mechanisms represented by the variables and parameters.

The bifurcation perspective clarifies why gradual changes in a condition can produce discontinuous changes in observed behavior. If a slowly varying parameter moves a system toward a point where the qualitative structure of the dynamics changes, a small additional parameter change can be associated with a large shift in the realized state or long-run regime. This provides one mathematical route to abrupt transition. Other routes also exist. Noise can induce movement between coexisting basins, rapid forcing can generate rate-dependent transitions, and a large external perturbation can cross a basin boundary without any underlying bifurcation. Abrupt empirical change therefore does not uniquely identify a bifurcation mechanism.

The literature on critical transitions develops one important application of this reasoning. Scheffer and colleagues review systems in which approaching thresholds can be associated with declining recovery rates and statistical indicators linked to *critical slowing down* (Scheffer et al. 2009). Near some bifurcations, the dominant restoring dynamics weaken, so perturbations decay more slowly and time series can show changes such as increased autocorrelation or variance. These signals are conditional diagnostic resources rather than universal predictors. Their interpretation depends on the type of transition, the speed of forcing, noise structure, sampling, stationarity assumptions, and the adequacy of the underlying model.

The term *critical transition* should also remain distinct from several neighboring uses of *criticality*. A bifurcation parameter can take a critical value in the technical sense of bifurcation theory. Critical phenomena in statistical physics concern another body of theory involving collective behavior, scaling, and phase transitions. Self-organized criticality refers to still another family of models. Later complexity



theory can draw relations among these traditions where justified, but shared vocabulary alone does not establish a common mechanism.

For economic and social analysis, bifurcation theory offers a disciplined alternative to purely linear extrapolation. An institution, ecological-economic system, credit network, technological regime, or pattern of collective behavior may respond differently as underlying conditions move across parameter ranges. The relevant parameter may itself summarize a complex set of relations, so empirical application requires caution. A diagram that contains a bifurcation proves a property of the model. Establishing that a historical economy approaches a corresponding transition requires measurement, parameter identification, mechanism evidence, and comparison against alternative explanations.

Bifurcations also sharpen the meaning of resilience. Within a given dynamical model, resilience can concern the rate of return after perturbation, the size or geometry of a basin, the distance to a basin boundary, or the persistence of a regime under parameter change. These quantities need not move together. A system can recover quickly from small disturbances while remaining close to a parameter threshold; another can recover slowly yet possess a large basin. Treating resilience as a single scalar property can therefore conceal several dynamical questions.

The later GR and GRE inheritance is again selective. Bifurcation theory provides a formal language for qualitative transformation, threshold effects, multistability, and changes in stability structure. It makes possible an analysis in which transformation concerns the organization of possible trajectories rather than only the magnitude of a variable. GR adds a historically broader question concerning the generation of the parameters, relations, and state variables through which the bifurcation description is constructed. In social settings, actors can respond to perceived thresholds, institutions can redefine the relevant variables, and governance can alter the mechanisms whose stability is being analyzed. These reflexive processes require further theoretical work beyond classical bifurcation analysis.

### 2.31.5 Time-Dependent and Changing Dynamics

Classical introductions often begin with autonomous systems, in which the evolution rule has no explicit dependence on clock time. Many empirical processes instead face seasonal forcing, technological change, environmental drift, policy intervention, demographic transition, or other conditions that vary through time. Nonautonomous dynamical-systems theory formalizes this situation by allowing the evolution law itself to depend explicitly on time. Equation 2.2 gives the basic continuous-time form.

$$\dot{x}(t) = f(t, x(t)). \quad (2.2)$$

The explicit time dependence in Equation 2.2 changes several familiar concepts. Time translation no longer leaves the dynamics unchanged in the same way as in an autonomous system. Long-run behavior can depend on when a trajectory is initialized, and the appropriate concept of attraction can require attention to both observation time and initialization time. The modern theory of nonautonomous dynamical systems therefore develops formulations in terms of processes and skew-product

flows as well as concepts such as pullback attractors, nonautonomous bifurcations, and time-dependent invariant structures (Kloeden and Rasmussen 2011).

This extension is important because many apparently stable regimes exist under continually changing external conditions. A seasonal ecological cycle, a periodically forced engineering system, or an economy under changing policy and technology can display regularity without being generated by a time-independent rule. The state observed at time  $t$  is then shaped by both the system's current configuration and the temporal conditions represented in  $f(t, x)$ . An attractor defined for an autonomous system may no longer capture the relevant organization of motion.

Time dependence can enter in several ways. A parameter can drift slowly. External forcing can be periodic, irregular, or episodic. Switching rules can move the system among different vector fields. Coupled subsystems can make a quantity that appears externally imposed in one reduced model into a state variable of a larger model. In some cases, enlarging the state space can convert an explicitly time-dependent formulation into an autonomous one by representing the forcing process as part of the state. This mathematical technique is powerful, but it relies on a specified higher-level evolution law. It does not remove the substantive task of determining what generates the forcing and whether the enlarged state description remains adequate.

The distinction between a changing state and changing dynamics is especially consequential for later GR. In Equation 2.1, the state changes while the rule  $f$  is fixed. In Equation 2.2, the effective rule varies with time according to a specified dependence. A still stronger problem arises when the mechanisms, variables, interaction structures, or rules through which future changes are produced become transformed through the history of the system itself. Some such processes can be represented within adaptive, switching, stochastic, or higher-dimensional dynamical models. Others require the modeler to revise the state space or model class because the relevant entities and relations have changed.

This stronger possibility should be stated without turning it into a claim that classical dynamical-systems theory is inadequate in general. Mathematics can represent changing laws at multiple levels whenever the relevant meta-dynamics can be specified. The epistemic difficulty is that a social analyst may not know in advance the complete space of future variables, institutions, technologies, interpretations, or relations. A fixed higher-dimensional representation can then function as a useful modeling hypothesis rather than a guarantee that historical novelty has already been contained within the formalism.

For GRE, the importance of time-dependent dynamics is therefore twofold. First, it prevents equilibrium or stability analysis from silently assuming a stationary environment. Economic trajectories can unfold while ecological constraints, technologies, institutions, preferences, classifications, and governance arrangements change. Second, it provides a disciplined precursor to the generative-relational idea that conditions of change can themselves become objects of change. The inheritance should remain carefully layered: autonomous dynamics studies motion under a fixed rule; nonautonomous dynamics studies motion under explicitly varying rules or forcing; generative-relational analysis asks when the relations that constitute states, rules, parameters, and relevant system boundaries are themselves historically produced and transformed.

The dynamical-systems lineage can now be located within the wider genealogy of Chapter 2. State spaces provide representations of possible configurations. Trajectories organize change through time. Attractors describe recurrent or asymptotically organizing structures and their basins. Bifurcations describe qualitative changes in the organization of dynamics, while critical-transition research develops domain-specific questions concerning abrupt shifts and possible warning signals. Nonautonomous theory extends the framework to explicitly changing conditions. Together these concepts give GR and GRE a mature language for persistence, path, sensitivity, regime structure, and transformation without requiring a commitment that social reality is exhausted by a fixed dynamical model.

The remaining limitation also prepares the next lineage. Dynamical-systems theory can generate extraordinarily rich behavior from relatively compact evolution laws, yet many social, biological, technological, and economic systems involve heterogeneous populations, distributed adaptation, changing interaction networks, multiscale organization, and emergent collective patterns. Complexity and complex-adaptive-systems traditions place those features more directly at the center of analysis. Section 61 therefore turns from the geometry of trajectories and qualitative change to the distributed and multilevel organization of complex adaptive systems.

## 2.32 Complexity and Complex Adaptive Systems

Dynamical-systems theory provides a language for states, trajectories, stability, attractors, bifurcations, and changing evolution rules. Complexity research shifts the analytical emphasis toward systems in which many interacting components generate collective patterns while their own behavior may also change in response to those patterns. The role of this section is to reconstruct the principal intellectual resources associated with complexity and complex adaptive systems before they are translated into later GR and GRE questions. Its objective is to distinguish five recurring themes: emergence, nonlinearity, adaptation, multiscale organization, and coevolutionary dynamics. The section treats these themes as a family of partially overlapping research traditions rather than as a single unified theory. Its method is genealogical and analytical: it identifies characteristic problems, clarifies the distinctions among them, and limits later GR/GRE synthesis to a restrained account of what these traditions make conceptually available (Holland 2012; Levin 1998).

Complexity research inherits problems from statistical physics, biology, ecology, cybernetics, dynamical systems, computer science, and economics, while changing the balance among them. The characteristic object is frequently a population or ensemble of interacting components whose aggregate behavior is difficult to infer by examining a representative component in isolation. Local interactions can create regularities at larger scales; the larger-scale configuration can in turn alter the conditions under which local components act. Heterogeneity, feedback, adaptation, path dependence, and distributed organization consequently become central explanatory concerns. This orientation has encouraged analytical tools ranging from nonlinear dynamics and network analysis to agent-based modeling and evolutionary computation. The unity of the field lies more securely in a recurring problem-space than in a single formalism.

For economic inquiry, this problem-space is especially consequential. Firms, households, financial actors, regulators, infrastructures, technologies, and institutions interact under conditions in which expectations and strategies respond to outcomes generated by previous interaction. Aggregate economic patterns can thereby alter the environment faced by their own participants. Complexity economics has used this recursive structure to study processes of formation, adaptation, and novelty that receive less emphasis in equilibrium-centered representations (Arthur 1999). The resulting vocabulary is highly relevant to GRE, while its concepts require local justification. Emergence, adaptation, hierarchy, and coevolution identify different analytical problems; their combination in a particular model should be demonstrated rather than presumed.

### 2.32.1 Emergence

Emergence concerns the appearance of organized properties, patterns, or regularities at one level of description through interactions occurring among components represented at another. The concept acquired different meanings across philosophy, physics, biology, and complexity science. Section 2.10 reconstructed earlier philosophical and social-theoretical lineages of emergence. Complexity research gives the concept a more explicitly constructive and model-oriented form: the analyst specifies local components and interaction rules and studies whether a collective pattern arises from their repeated interaction. The resulting macro-pattern can be causally or explanatorily significant even when it is generated from lower-level processes.

Anderson's argument that "more is different" became an influential statement of the methodological importance of higher-level organization. His claim concerns the autonomy of explanatory concepts across scales: knowledge of more fundamental laws does not automatically supply the concepts needed to explain organized behavior at higher levels (P. W. Anderson 1972). Complexity research develops a related insight through models in which collective organization arises from numerous interacting units. The relevant explanatory question becomes how local interactions generate a pattern, which properties of the pattern are robust across variations of the micro-description, and which macro-properties feed back into the behavior of components.

Emergence therefore differs from simple aggregation. If a population-level quantity is obtained by summing independent contributions, the aggregate may require little additional organizational explanation. Emergent patterns become analytically interesting when interactions among components alter the structure of the aggregate: clustering, synchronization, spatial patterning, institutional regularity, conventions, segregation, cascades, or market organization can depend on who interacts with whom, how interaction is sequenced, and how agents respond to previous outcomes. The system-level object can then carry information that is difficult to recover from a list of isolated component properties.

Agent-based modeling made this constructive orientation especially visible in the social sciences. Epstein and Axtell's *Growing Artificial Societies* develops bottom-up simulation as a method for examining how aggregate social patterns can arise from repeated interactions among heterogeneous agents (Epstein and Axtell 1996).

In this approach, the model is generative in a methodological sense: a proposed micro-specification is used to generate an aggregate outcome computationally. The resulting correspondence between a simulated pattern and an empirical pattern can support an explanatory hypothesis, while additional work remains necessary to establish empirical adequacy, parameter plausibility, mechanism identification, and comparative performance against alternative models.

This distinction is important for later GR vocabulary. Computational generation within a model means that an aggregate pattern is produced by specified rules, initial conditions, interactions, and update procedures. GR's later concept of generativity is broader and concerns the production and transformation of capacities, relations, subjects, structures, and future conditions. The two notions can intersect, but they occupy different theoretical levels. Chapter 2 therefore treats complexity-science emergence as an inherited analytical resource rather than as an already complete theory of generative relational reality.

Emergence also creates a problem of level selection. A pattern can appear stable at one scale while remaining highly variable at another. A city can display persistent spatial organization while households move; a market can preserve institutional routines while firms enter and exit; an ecosystem can maintain broad functional organization while species abundances fluctuate. The appropriate explanatory level depends on the question, time horizon, and observational resolution. Emergent description consequently introduces an epistemic task: the analyst must justify why a selected macro-pattern is meaningful and which lower-level variations can be treated as irrelevant for the purpose at hand.

The principal inheritance for GRE is therefore a disciplined distinction between local interaction and collective organization. Economic order can be studied as something produced through interaction rather than treated exclusively as an externally given constraint or a direct expression of representative-agent properties. The stronger question of how the categories used to identify agents, interactions, and aggregate patterns are themselves historically formed remains open for later GR development.

### 2.32.2 Nonlinearity

Nonlinearity supplies a second foundation of complexity analysis. Section 2.31 introduced nonlinearity through dynamical systems, where the effect of a change can depend on the current state and interactions among variables. Complexity research extends this concern to systems composed of many interacting elements. A local response can alter the environment encountered by other components; those responses can modify the aggregate pattern; and the changed aggregate can alter later local behavior. The resulting mapping from individual changes to collective outcomes can therefore depend strongly on configuration, sequence, interaction structure, and feedback.

Levin's treatment of ecosystems as complex adaptive systems emphasizes this connection among localized interactions, nonlinearity, historical dependence, multiple possible outcomes, self-organization, and dynamics operating at several levels (Levin 1998). The importance of nonlinearity here lies less in mathematical ornament than



in a change of explanatory expectation. The aggregate effect of two interventions need not equal the sum of their separate effects. Similar disturbances can yield different consequences under different configurations. A component's effect can change as population composition, spatial structure, institutional environment, or interaction topology changes.

Several concepts that often travel together should remain distinct. Nonlinearity describes a property of a relation or evolution rule. Positive feedback describes a mechanism through which deviations can be amplified. Multiple equilibria or attractors describe possible system-level organizations under specified dynamics. Path dependence concerns the influence of historical sequence or earlier states on later possibilities. Chaos refers to a more specific class of deterministic dynamical behavior. Complexity research may combine these phenomena, but one does not follow automatically from another. A nonlinear system can possess a single stable equilibrium; a path-dependent process can arise through institutional increasing returns without exhibiting deterministic chaos; an aggregate pattern can be complex because of heterogeneous interaction even when each component follows a simple rule.

Economics provides a clear illustration through increasing returns and adaptive response. Arthur's earlier work on competing technologies shows how increasing returns can make historical events consequential for later adoption and possible lock-in under specified mechanisms (Arthur 1989). His later complexity-economics formulation places this historical dependence within a broader picture in which economic agents continually adapt to a situation that their own actions jointly create (Arthur 1999). Prices, strategies, expectations, technological choices, and institutional arrangements can thereby participate in recursively changing environments.

This perspective changes the analytical status of averages. In linear or weakly interacting settings, average behavior may summarize a population effectively. In strongly interactive systems, an average agent can erase the variation that produces the aggregate phenomenon. Heterogeneous expectations can create trading dynamics absent from a representative expectation; heterogeneous balance sheets can generate networked financial vulnerability; heterogeneous technological positions can shape diffusion and competitive selection. Complexity methods therefore frequently preserve distributions, local interaction structures, or agent-level rules when those features are part of the mechanism being studied.

Nonlinearity also complicates intervention. A policy applied in one regime can have effects that change as the system reorganizes. Responses may saturate, reverse, or trigger indirect pathways through other actors. This does not imply that prediction or policy analysis becomes impossible. It changes the evidential burden. Analysts need to specify the relevant regime, interaction mechanisms, uncertainty, and plausible feedbacks, and they may need to compare outcomes across ensembles of scenarios rather than rely on a single local extrapolation.

For GRE, the inherited lesson is that relational effects can be configuration-dependent. The economic significance of a relation can depend on surrounding relations, institutional conditions, and temporal position. Later GRE can extend this insight toward value conversion, capability formation, power, and governance. The complexity lineage itself supplies the methodological reason to expect interaction effects and recursive feedback, while the substantive interpretation of those effects

remains domain-specific.

### 2.32.3 Adaptation

Complex adaptive systems add adaptation to interaction. Components change behavior, internal rules, strategies, or organization in response to experience and to the environments created through ongoing interaction. Holland's work made this adaptive orientation central to complexity research, first through genetic algorithms and adaptive systems and later through a more general framework of signals, boundaries, agents, and evolving organization (Holland 2012). Adaptation can occur through learning within an agent, selection among agents or strategies, recombination of rules, organizational revision, or population change. These mechanisms should be distinguished because they imply different units of persistence and different causal pathways.

Adaptation is relational in a limited but important sense. The success of a strategy depends on the environment in which it operates, and that environment can include other adapting agents. A behavior that performs well under one population composition can perform poorly after other agents change. Fitness, payoff, or performance is therefore frequently context-dependent. The analytical object becomes a moving relation among agent, strategy, environment, and population rather than a fixed ranking of alternatives.

This feature separates adaptation from optimization under a fixed objective and fixed environment. Optimization can be part of an adaptive model when agents repeatedly solve defined problems, but complexity research often studies situations in which the relevant environment changes while agents adjust. Search may be local, information incomplete, and learning distributed. Strategies can be revised using heuristics, imitation, reinforcement, experimentation, or evolutionary selection. Different mechanisms can produce similar aggregate outcomes, so empirical work needs evidence concerning how adaptation actually occurs.

Adaptation also differs from improvement. A system can become better fitted to a local environment while producing fragility at another scale or time horizon. A firm can adapt successfully to an institutional regime that is ecologically damaging; a pathogen can adapt in ways harmful to human welfare; a financial strategy can remain individually profitable while increasing systemic vulnerability. The criterion of adaptation belongs to the modeled relation between performance and environment. Normative assessment requires additional criteria concerning welfare, justice, sustainability, rights, or other values.

The role of internal representation varies across complex adaptive systems. Biological evolution can generate adaptation without reflective anticipation by individual organisms. Human and organizational agents can model possible futures, interpret signals, form expectations, and deliberately alter strategies. Arthur emphasizes this additional complication in economic systems: economic agents respond strategically to patterns they help create (Arthur 1999). Expectations about others' expectations can make the adaptive environment partly representational. Beliefs, narratives, classifications, and models can then participate in the process they attempt to describe.

This reflexive capacity makes economic adaptation distinct from a straightforward

transfer of biological selection language. Institutional rules can be contested and redesigned. Agents can coordinate to alter the environment against which performance is assessed. Governments can change market architecture, firms can create standards, communities can establish governance rules, and technologies can create new categories of action. Adaptive economic analysis therefore benefits from evolutionary analogies while retaining attention to interpretation, deliberate intervention, authority, and institutional construction.

Agent-based models provide one way to study such adaptation explicitly. Heterogeneous agents can be given learning or updating rules, allowed to interact, and observed as aggregate patterns develop. The method permits mechanisms that are difficult to solve analytically, but computational richness also enlarges the space of modeling choices. A simulated adaptive outcome is evidence about the specified model. Empirical application requires sensitivity analysis, calibration or estimation where appropriate, validation against relevant observations, transparency concerning update rules, and comparison with plausible alternatives.

GRE inherits from this tradition a view of economic actors and institutions as potentially adaptive rather than behaviorally fixed. This inheritance supports later analysis of changing capabilities, strategies, norms, and organizational forms. GR asks a further question when adaptation alters the categories through which future adaptation occurs: actors can acquire new capacities, relations can create new constraints, and institutions can redefine what counts as a feasible action or relevant performance criterion. Complexity research supplies several formal routes for representing such changes; the adequacy of any route remains an empirical and theoretical question rather than a conclusion supplied by the label “adaptive.”

#### **2.32.4 Multiscale Organization**

Complex systems are frequently organized across multiple scales. Components form intermediate structures; intermediate structures participate in larger wholes; processes unfold at different temporal rates; and causal influence can travel across levels. Simon’s “architecture of complexity” provided an early and influential account of hierarchical and near-decomposable organization, emphasizing that complex systems can often be analyzed through nested subsystems whose internal interactions are stronger or more frequent than interactions across some subsystem boundaries (Simon 1962). The concept of hierarchy in this lineage concerns organized levels and subsystems in a broad analytical sense. It is wider than a hierarchy of command or authority.

Near-decomposability offers a practical reason why multiscale analysis is possible. If some interactions are relatively dense within subsystems and weaker across them, short-run dynamics can sometimes be studied locally while slower cross-system effects are represented at a higher level. This is a modeling advantage rather than a claim that natural or social systems possess perfectly separated layers. Boundaries can be porous, overlapping, and historically changeable. The usefulness of a scale depends on whether the processes relevant to the research question exhibit sufficient regularity at that resolution.

Anderson’s argument for explanatory autonomy at higher levels complements this

architectural view (P. W. Anderson 1972). Higher-level concepts can become necessary because organization introduces regularities that are cumbersome or uninformative when expressed entirely in lower-level terms. Temperature, ecological community, organization, institution, and market are examples of concepts whose explanatory roles depend on aggregation and structure. In the social sciences, higher levels also involve meanings, rules, and legal or institutional categories that may be constituted through collective recognition rather than merely summarized from physical components.

Levin's complex-adaptive-systems analysis places multiscale organization at the center of ecology. Local interactions and selection processes can generate larger-scale patterns, while ecological and evolutionary dynamics unfold at multiple levels and timescales (Levin 1998). This creates a recurring analytical problem: patterns that appear stable at one level can be produced by continuous turnover at another, and interventions aimed at one scale can generate effects elsewhere. Multiscale models therefore require explicit choices concerning aggregation, coupling, temporal resolution, and the variables preserved when moving between scales.

Economic systems display comparable organizational plurality. Transactions occur among persons and firms; firms contain teams, departments, routines, and technical infrastructures; industries contain networks, standards, and competitive structures; states create legal and monetary institutions; global production and finance connect these organizations across jurisdictions. A relation can be local in one representation and part of a higher-order structure in another. The effect of a policy can depend on household practices, firm organization, sectoral networks, national institutions, and international constraints operating together.

Multiscale organization should remain distinct from a single upward chain of causation. Local interactions can produce aggregate structures, while established aggregate structures condition local possibilities. A monetary regime shapes firm and household action; accumulated transactions and political decisions can later transform the monetary regime. Organizational routines constrain members; member practices can gradually alter routines. Complexity research often represents such cross-level influence through coupled models, coarse-graining, network structure, nested agents, or adaptive rules. Each representation captures selected pathways while suppressing others.

This creates a scale-selection problem for explanation and governance. A pattern visible at one scale can disappear under aggregation or become noisy under disaggregation. Statistical relationships can reverse when populations are partitioned differently. A governance intervention can appear effective according to an aggregate indicator while distributing gains and losses unevenly among subgroups. Multiscale analysis therefore has an epistemic and normative dimension: the chosen resolution affects which relations, heterogeneities, and harms become visible.

GRE inherits from the complexity tradition the idea that economic organization may require several interacting levels of description. Later chapters can use this resource when examining persons, households, organizations, infrastructures, sectors, states, and transnational systems without assuming that one scale provides the complete explanatory unit. GR's stronger contribution concerns the historical production of scales themselves: organizations split or merge, jurisdictions are created,

categories are redefined, and new infrastructures connect previously separated domains. Multiscale complexity makes cross-level organization analytically tractable; generative-relational inquiry adds the question of how the levels and boundaries used in that analysis come into being and change.

### 2.32.5 Coevolutionary Dynamics

Coevolutionary dynamics arise when changes in one population, subsystem, strategy set, or institutional domain alter the selective or adaptive environment of another, whose response in turn changes the conditions faced by the first. The concept emerged most prominently from evolutionary biology and ecology and later traveled into studies of technology, organizations, institutions, and economies. Within complexity research, coevolution extends adaptation from a system facing a largely fixed environment toward mutual adjustment among interacting systems or populations.

Holland's complex-adaptive-systems framework treats adaptive agents, signals, boundaries, recombination, and hierarchical organization as interacting components of evolving systems (Holland 2012). Levin similarly emphasizes the joint ecological and evolutionary development of complex systems, including the interaction between local processes and larger-scale system properties (Levin 1998). In economics, Arthur's complexity perspective describes agents adapting to aggregate patterns that they collectively generate; the changed aggregate then becomes the environment for further adaptation (Arthur 1999). These formulations share a recursive structure even though their mechanisms and domains differ.

Coevolution is more specific than simultaneous change. Two variables can change during the same period because both respond to a third factor. Coevolutionary explanation requires some reciprocal dependence between their changes. The relevant coupling can be direct, as when two populations alter each other's selection environment, or mediated through a shared institutional or ecological structure. The strength, delay, and direction of coupling can vary over time. Empirical identification therefore requires evidence about interaction pathways rather than temporal correlation alone.

The concept also differs from generic feedback. Feedback can occur within a fixed architecture: an output affects a later input while the relevant actors, variables, and update rules remain stable. Coevolution often emphasizes that adaptive responses alter the configuration within which later feedback occurs. A technology changes user practices; user practices influence complementary technologies, standards, and regulation; these changes alter the later developmental environment of the original technology. Firms and institutions can likewise evolve together as organizational strategies affect regulation, labor markets, financial practices, and competitive norms that subsequently reshape firm behavior.

Path dependence becomes especially important in such settings. A coevolutionary process can generate opportunities that were unavailable earlier and close possibilities that once existed. Early events can alter the population of strategies, institutional infrastructure, or technical standards against which later adaptations occur. Arthur's increasing-returns analysis gives one bounded economic mechanism through which historical events can shape later technological selection (Arthur 1989). Complexity re-



search generalizes the research orientation by asking how adaptive interaction continually modifies the landscape of subsequent adaptation.

The metaphor of an adaptive landscape is useful but requires care. In simple evolutionary models, a landscape can represent a relatively fixed mapping from configurations to fitness. Under coevolution, the performance landscape faced by one actor changes as other actors change. The landscape itself therefore becomes time-dependent and relational. Economic analogues are especially reflexive because agents can deliberately modify standards, property rights, organizations, market rules, or technologies. The object of analysis can shift from movement across a given landscape toward processes that reshape the landscape.

This point approaches, while remaining distinct from, later GR concerns. Complexity and coevolutionary theories already provide substantial resources for studying changing interactions, adaptive environments, emergent structures, and recursive adjustment. GR should therefore avoid presenting relational change or coevolution as absent from predecessor theories. Its additional question concerns cases in which interaction generates new actors, new relation types, new capacities, new evaluative criteria, or new rules for producing subsequent transformations. Some complexity models can represent these processes through changing networks, evolving grammars, endogenous rule sets, or open-ended evolutionary mechanisms. The theoretical issue is to specify which form of novelty is represented and which remains outside the model.

For GRE, coevolution offers a particularly important bridge among technology, institutions, capabilities, values, and economic organization. Technologies can alter feasible practices and skill demands; institutions can shape technological incentives; changing capabilities can alter demand and political participation; valuation practices can influence investment and organizational priorities. These relationships can form mutually transforming histories. The complexity lineage encourages their study as coupled processes rather than as isolated comparative statics.

The broader contribution of complexity and complex-adaptive-systems research can now be stated with appropriate restraint. Emergence directs attention to collective patterns generated through interaction. Nonlinearity makes effects conditional on configuration and feedback. Adaptation introduces learning, selection, and strategic adjustment. Multiscale organization locates dynamics across nested or overlapping levels. Coevolution studies reciprocal change among adapting populations, structures, and environments. Together these traditions provide GR and GRE with a mature vocabulary for distributed organization and historically contingent system formation.

Their inheritance also clarifies the next analytical requirement. Complexity models often depend on explicit representations of who interacts with whom, which connections carry influence, how local neighborhoods are formed, and whether several kinds of relations coexist. Those questions move the genealogy from general complexity toward the formal representation of relational architecture. Section 62 therefore turns to networks, hypergraphs, and multilayer approaches, where ties, higher-order interactions, and multiple relation types become explicit objects of mathematical analysis.

## 2.33 Network, Hypergraph, and Multilayer Approaches

Complexity research places interaction structure near the center of explanation. Network theory makes that structure an explicit object of representation by distinguishing the units under study from the relations that connect them. The role of this section is to reconstruct the principal formal lineages through which relational structure has been represented beyond collections of isolated variables. Its objective is to distinguish five increasingly expressive analytical forms: ordinary network representation, dynamic or temporal networks, higher-order interaction and hypergraphs, multilayer relational structures, and evolving relational topologies. The method is formal and genealogical. Each representation is introduced through the problem it solves, the distinctions it makes available, and the assumptions it retains. The resulting concepts provide important resources for later GR and GRE, while a mathematical relation in a model remains an analytical representation rather than an automatic claim about the ontology of social or economic reality (Newman 2003; Battiston et al. 2020).

Network approaches alter the explanatory unit in a way that is especially important for relational inquiry. A conventional variable-centered model can describe attributes of firms, households, persons, institutions, or technologies while leaving their pattern of connection implicit. A network representation places that pattern alongside the attributes themselves. Degree, clustering, centrality, component structure, assortativity, path length, community structure, and related quantities can then describe how relational position differs across nodes and how local connections compose into larger structures (Newman 2003). This does not make network analysis intrinsically more relational than every alternative method. It does, however, force the modeler to state which units are connected, what counts as a relation, whether the relation is directed or undirected, whether its strength or sign matters, and which observed interactions are treated as belonging to the same relational structure.

For economics, this representational move has obvious relevance. Production, finance, trade, employment, ownership, information exchange, technological dependence, and organizational collaboration can all involve structured relations whose consequences depend on position and connectivity. Yet the same pair of firms can be connected through supply, credit, ownership, litigation, technological licensing, and personnel mobility at once. A relation can also exist only during particular intervals or arise through group interaction that cannot be reduced without loss to independent dyads. The development from simple graphs toward temporal, higher-order, and multilayer formalisms responds to these limitations. The genealogy is therefore best understood as an expansion of what counts as representable relational structure rather than as a sequence in which newer formalisms render ordinary networks obsolete.

### 2.33.1 Network Representation

The basic network representation consists of a set of nodes and a set of relations among them. In graph-theoretic language, a graph can be written as  $G = (V, E)$ , where  $V$  is a set of vertices and  $E$  is a set of edges connecting selected pairs of vertices.

The formal simplicity of this representation is one of its strengths. A large variety of empirical systems can be translated into a common relational language, after which structural properties can be compared and processes on those structures can be studied. Modern network science expanded this program across social, biological, technological, and information systems and developed a shared vocabulary for degree distributions, clustering, correlations, random graph models, growth mechanisms, and dynamical processes on networks (Newman 2003).

The simplicity of  $G = (V, E)$  also conceals a substantial act of model construction. Nodes do not identify themselves. A researcher decides whether a node represents an individual, firm, household, country, legal entity, technological component, document, account, or other unit. Edges likewise depend on an operational definition: communication, exchange, ownership, co-presence, contractual dependence, citation, kinship, similarity, or another relation. Different choices can produce different networks from the same empirical domain. Network analysis therefore begins with an ontology of representation even when it suspends stronger claims about the ontology of the represented world.

Several distinctions enrich the basic graph. Edges can be directed when the relation has an ordered source and target, as with lending, citation, or command. They can be weighted when intensity, frequency, quantity, or capacity matters. Signed networks distinguish relations with different valences, such as support and opposition or credit and liability under an appropriate model. Self-loops may be meaningful in some domains and excluded in others. Node and edge attributes add information without changing the basic pairwise architecture. Each extension answers a distinct empirical question; combining them should follow the structure of the problem rather than a preference for formal richness.

An adjacency representation makes pairwise structure computationally explicit. For a simple network with nodes indexed by  $i$  and  $j$ , an adjacency matrix can record whether the modeled relation is present between each pair. Weighted and directed variants replace the binary entry with the relevant magnitude and orientation. Such matrices support linear-algebraic analysis of paths, connectivity, spectral structure, diffusion, and centrality, but the matrix remains a representation of a chosen relation. A zero can mean that no relation exists, that no relation was observed, that the relation falls below a threshold, or that the data-generating system does not record it. Measurement and missingness therefore remain part of network epistemology.

Network measures also require interpretive discipline. High degree can indicate many direct connections, yet the substantive meaning of those connections depends on the relation being measured. Betweenness can identify nodes that lie on many shortest paths, but shortest paths may or may not approximate the routes through which information, goods, authority, or contagion actually move. Eigenvector-based measures privilege connection to structurally prominent neighbors under specific recursive assumptions. Community-detection procedures can reveal densely connected regions, while different algorithms and resolution choices can produce different partitions. Formal centrality and substantive power are consequently related only through an additional theory of how network position becomes consequential.

This distinction is particularly important for GRE. Economic power can be mediated by network position, but centrality is not itself a complete theory of power. A

supplier with few connections can hold substantial bargaining power when its product is difficult to substitute; a highly connected worker can remain institutionally vulnerable; a peripheral legal actor can possess decisive formal authority. Network analysis supplies relational observables and structural hypotheses. Institutions, rights, resources, capabilities, and normative rules determine how those structural positions are translated into effective possibilities.

Ordinary networks nevertheless provide a major conceptual inheritance. They make relational topology inspectable. They allow the same set of nodes to support different patterns of connection and thereby separate properties of units from properties of arrangement. They also demonstrate that aggregate outcomes can depend on who is connected to whom rather than solely on the distribution of individual attributes. This creates a bridge from the interaction-centered concerns of Section 61 to a more explicit formal treatment of relational structure.

### 2.33.2 Dynamic Networks

A static network represents relations as though they were simultaneously available during the observational window. Many empirical relations are instead intermittent, ordered, and historically changing. Communication occurs at particular times; transactions open and close; employment and ownership ties begin and end; transport links operate according to schedules; alliances and contractual relations change. Temporal-network analysis makes the timing of edges part of the representation rather than collapsing all observed contacts into a single aggregate graph (Holme and Saramäki 2012).

This extension produces an important distinction between *dynamics on a network* and *dynamics of the network*. In the first case, a process such as diffusion, contagion, learning, synchronization, or exchange evolves while the network is treated as fixed. In the second, the pattern of nodes and edges itself changes. Empirical systems can contain both at once. A financial shock can propagate over a credit network while lenders simultaneously terminate, create, or redirect credit relations; information can spread through a communication network while the communication pattern responds to the information being spread. Treating these two dynamics separately can be a useful approximation, but their coupling is a substantive assumption rather than a general property.

Temporal ordering can alter reachability even when the time-aggregated network is unchanged. If an edge from  $A$  to  $B$  is active only after an edge from  $B$  to  $C$  has disappeared, the aggregated graph may display a path  $A-B-C$  even though no time-respecting sequence permits a process to travel from  $A$  to  $C$  during the relevant interval. Temporal-network theory therefore distinguishes structural connectivity from temporally feasible connectivity. Durations, waiting times, burstiness, recurrence, and ordering can affect diffusion and coordination in ways that disappear when contacts are aggregated (Holme and Saramäki 2012).

The choice of temporal resolution is itself consequential. Relations recorded by the second can appear highly intermittent; the same data aggregated by day can appear dense and stable. Long observational windows can combine relations that never coexisted, while very short windows can hide durable organization behind sparse in-

stantaneous observations. A temporal network is thus not simply a static network with more data. It requires a model of which temporal distinctions matter for the process being studied.

Dynamic-network representations also clarify several meanings of persistence. A tie can persist continuously, recur intermittently, or disappear while being replaced by functionally similar ties. A network can preserve a stable degree distribution even while individual edges turn over rapidly. Community structure can remain recognizable although membership changes. Conversely, stable node identities can coexist with a major reorganization of connectivity. These are different forms of continuity and should not be compressed into a single claim that a relational structure is stable.

For economic analysis, the distinction matters whenever timing changes feasible action. Liquidity depends on when obligations mature, supply chains depend on sequencing and delivery windows, labor relations have contractual durations, and information advantages can depend on the order in which knowledge travels. A static graph can remain useful for long-run structural questions, while a temporal representation becomes necessary when ordering, duration, or turnover changes the mechanism of interest. The appropriate choice is therefore governed by the explanatory problem rather than by an assumption that temporal detail is always superior.

Dynamic networks provide GRE with a formal language for histories of connection. They make it possible to study not only whether relations exist but when they become available, how long they remain, and how sequences of relations constrain later possibilities. Yet most temporal-network models still prespecify what counts as a node and which type of contact is being recorded. The history of connectivity can be endogenous while the categories through which connectivity is recognized remain fixed. Later GR analysis can retain the temporal insight while asking how those categories themselves arise and change.

### 2.33.3 Higher-Order Interaction and Hypergraphs

Ordinary graphs encode interaction through pairs. This is appropriate when the modeled relation can be represented as a collection of dyadic links or when pairwise approximation preserves the mechanism of interest. Many processes, however, involve groups whose joint interaction is not equivalent to the sum of independent pairwise relations. A committee decision, team production process, multi-party contract, chemical reaction, household allocation, coalition, or group conversation can depend on the simultaneous participation of several units. Higher-order network approaches develop representations for this class of problem (Battiston et al. 2020).

A hypergraph replaces the requirement that each edge join exactly two nodes. In a hypergraph  $H = (V, \mathcal{E})$ , a hyperedge  $e \in \mathcal{E}$  can contain more than two vertices. The formal object therefore records a group relation directly. If persons  $A$ ,  $B$ , and  $C$  jointly participate in a single institutional decision, the hyperedge  $\{A, B, C\}$  retains that joint participation rather than automatically replacing it with the three pairwise links  $AB$ ,  $AC$ , and  $BC$ . This distinction matters whenever the collective relation has effects that arise only in the group configuration.

Pairwise projection can lose several kinds of information. It can erase the size of the interacting group, confuse repeated dyadic interactions with one genuinely collec-



tive event, and introduce links between members who were jointly present but did not possess an independent pairwise relation. More importantly, higher-order dynamics can generate thresholds and collective effects that cannot be reconstructed from pairwise coupling alone. Reviews of higher-order networks emphasize that interactions among three or more units can alter spreading, synchronization, cooperation, and other dynamical phenomena relative to pairwise network models (Battiston et al. 2020).

Hypergraphs are not the only higher-order representation. Simplicial complexes also represent relations among sets of vertices, but they impose an additional closure structure: when a simplex is present, its faces belong to the complex as well. A filled triangle therefore carries different formal commitments from an arbitrary three-node hyperedge. This difference can be analytically meaningful. A joint three-party institution does not necessarily imply that every corresponding dyadic institution exists independently. Hypergraphs are more permissive in such cases, whereas simplicial representations are useful when inclusion relations among lower- and higher-dimensional interactions are part of the phenomenon.

The move to higher-order structure should not be interpreted as a claim that dyads are generally inadequate. Many economic relations are explicitly bilateral: a loan contract, purchase, bilateral treaty, or employment agreement can often be represented productively as an edge, possibly with rich attributes. Higher-order formalisms become useful when the mechanism itself depends on joint participation. Model complexity should therefore follow interaction complexity.

This distinction has particular relevance for theories of production and value. Team output can depend on complementarities among several participants; common-pool governance can involve rule systems sustained by groups rather than a collection of independent exchanges; platform interactions can create group effects through shared infrastructures; and coalition formation can change what any bilateral relation means. A pairwise projection can still provide a useful approximation, but it may move the generative mechanism out of the representation.

Higher-order approaches thus broaden the formal meaning of relation. A relation need not connect exactly two predefined units. It can bind a set, carry internal dimensional structure, and alter processes through genuinely collective participation. This becomes an important resource for GR and GRE because relational generation may occur through configurations rather than isolated ties. At the same time, a hyperedge remains a modeled interaction category. The formalism does not decide which empirical groupings count as one relation, how participants acquire their identities, or how the meaning of collective membership changes historically.

#### **2.33.4 Multilayer Relational Structures**

A second limitation of ordinary networks arises when the same units participate in several kinds of relation. Social, economic, technological, and biological systems frequently contain multiple channels of connectivity, and these channels can interact. Multilayer-network theory develops a family of formalisms for representing such systems without collapsing heterogeneous relations into one edge set. The literature uses several related constructions, including multiplex, interconnected, interdependent,

and multilayer networks, with differences in how node sets and interlayer connections are specified (Kivelä et al. 2014).

A multiplex representation can place the same set of entities in several relation layers. Firms, for example, might be connected through ownership in one layer, supply dependence in another, credit in a third, and technological collaboration in a fourth. The resulting layers are analytically distinct even when they share nodes. A multilayer framework can also allow different node sets across layers and explicit connections between node-layer combinations. This makes it possible to represent systems in which infrastructures, organizations, persons, or institutions occupy different but coupled relational domains.

The multilayer perspective addresses a concrete information-loss problem. If several relation types are aggregated into one network, the resulting edge indicates that two units are connected but can erase the mechanism through which they are connected. Two firms with the same aggregate degree may occupy very different positions when one is central in credit relations and the other in technological collaboration. Cross-layer dependence can also create effects invisible within any single layer. A failure in an infrastructure layer can disable production links; ownership can condition bargaining within a supply network; legal jurisdiction can alter the consequences of financial connection. Multilayer formalisms make these distinctions representable (Kivelä et al. 2014).

Layers should not automatically be identified with ontological levels. A layer may represent a relation type, communication channel, spatial context, time interval, institutional domain, or measurement source. Multiscale organization, discussed in Section 61, concerns organization across scales or levels of description and can intersect with multilayer structure without being identical to it. A firm network and a national institutional system can differ in scale; ownership and credit networks among the same firms differ primarily in relation type. Keeping these distinctions separate prevents “layer” from becoming a generic synonym for any form of complexity.

Interlayer coupling introduces another analytical choice. Some layers can be treated as independent descriptions of the same nodes, while others contain causal or functional dependence. Movement between transportation layers, substitution between communication channels, or dependency between financial and production networks can require explicit interlayer relations. The strength and form of these couplings influence system-level behavior. As with ordinary edges, however, an interlayer edge is a modeling claim that requires substantive interpretation.

Multilayer representation is especially useful for political-economic analysis because economic action is rarely contained within one relational domain. Ownership, contract, authority, information, law, infrastructure, kinship, and reputation can jointly condition what actors can do. A single aggregated network can conceal which relation enables or constrains an outcome. A multilayer model offers one way to preserve heterogeneity while still studying cross-domain structure.

The GRE inheritance is therefore more specific than the general statement that reality has many layers. Multilayer network theory shows how distinct relation types can be represented simultaneously, how within-layer and cross-layer structures can be distinguished, and how aggregation choices can alter inference. It offers a formal

precursor to the GR concern with heterogeneous relations. Yet the formalism normally begins after the analyst has specified the relevant layers. GR later asks how a relation becomes recognizable as a distinct type, how institutional practice creates or dissolves layer boundaries, and how categories that organize heterogeneous relations are themselves generated.

### 2.33.5 Evolving Relational Topologies

The preceding approaches progressively enrich the representation of relational structure, but a further question concerns how topology changes in response to the processes occurring on it. Adaptive or coevolutionary network theory addresses systems in which node states affect connections and connections affect node states. The network is then neither a fixed background nor an independently varying environment. State dynamics and topology participate in a coupled process (Gross and Blasius 2008).

A schematic discrete-time representation makes the distinction visible. Let  $x_t$  denote the modeled states associated with the units and let  $G_t$  denote their relational topology at time  $t$ . Coupled evolution can be represented abstractly as

$$x_{t+1} = F(x_t, G_t), \quad G_{t+1} = H(G_t, x_t). \quad (2.3)$$

Equation 2.3 does not specify a substantive mechanism. Its role is to distinguish two directions of dependence. The first relation states that later node states depend partly on the current network; the second states that later network structure depends partly on current states. Adaptive-network research studies concrete versions of this coupled problem in domains ranging from epidemiology and ecology to opinion formation and game dynamics (Gross and Blasius 2008).

The distinction from an ordinary temporal network is important. A temporal network can change according to a schedule or externally specified process without responding to the states of the nodes. An adaptive network makes at least part of the topological change state-dependent. Individuals may avoid infected contacts; firms may reconfigure suppliers after disruptions; lenders may withdraw credit in response to perceived risk; collaborators may form ties after successful interaction. The changed network then modifies subsequent exposure, opportunity, and interaction. Feedback crosses the boundary between process and topology.

This creates a formal route for studying relational patterns that reinforce or undermine themselves. A pattern of interaction can change node states in ways that reproduce the same pattern of interaction. It can also generate states that destabilize the topology that produced them. Segregation, coordination, cooperation, polarization, financial concentration, and organizational clustering can therefore be studied through coupled state-topology dynamics when the empirical mechanism supports such a representation. Persistence need not reside exclusively in node attributes or in a fixed network; it can arise through their recurrent mutual adjustment.

Topology can also evolve without preserving the node set. Organizations enter and exit, firms merge, households split, jurisdictions are created, accounts are closed, and technical components are replaced. Many network models can accommodate node

birth and death, but a deeper conceptual issue then appears: the unit whose connections are being tracked can itself be historically transformed. If two organizations merge, the event changes more than an edge. It changes the set of represented entities. If a legal reform creates a new corporate form, the categories through which nodes are identified can change. These cases move toward the boundary between evolving topology and evolving ontology of representation.

This boundary is particularly significant for GR. Network science supplies powerful methods for making relations, timing, higher-order interaction, layer heterogeneity, and topological change explicit. Adaptive networks go further by allowing relations and states to coevolve. Yet most formal models still begin with a vocabulary that specifies what a node is, which relation types can occur, which attributes constitute a state, and where the modeled system ends. The topology can change dramatically while these meta-level specifications remain fixed.

The later generative-relational problem is therefore not solved merely by replacing a static graph with a dynamic one. GR asks when the production of nodes, relation types, boundaries, observables, and transformation rules must itself enter the analysis. A firm can be created by law, a market can be constituted by standards and infrastructures, a social category can become institutionally consequential, and a relation can acquire a new meaning through historical transformation. Some of these processes can be represented by enlarging the network model; others may require moving between representational schemes. Network formalisms remain valuable precisely because they make clear which objects have been allowed to vary and which have been held fixed.

For GRE, this yields a layered inheritance. Ordinary networks make relational topology explicit. Temporal networks introduce the history and ordering of ties. Hypergraphs and related higher-order structures allow collective interactions that exceed dyadic representation. Multilayer approaches preserve heterogeneous relation types and their couplings. Adaptive networks allow topology and states to modify one another. Together they provide a substantial formal vocabulary for studying economic relations without reducing economic structure to isolated attributes.

Their shared limit also prepares the next theoretical lineage. Networks primarily encode relations among distinguishable units, even when those relations are weighted, temporal, higher-order, layered, and adaptive. Some problems instead concern influences distributed throughout a surrounding domain, background structures that condition local relations, or transformations whose description depends on invariances across different representations. Field-based, gauge-sensitive, and background-aware formalisms address parts of this problem-space through a different mathematical vocabulary. Section 63 therefore turns from relational topology to fields, local dependence, invariance, and the role of background structure.

## 2.34 Field, Gauge, and Background-Sensitive Formalisms

Network approaches represent relations through connections among distinguishable units. Field-based formalisms begin from a different analytical problem: how to represent quantities, potentials, constraints, or conditions that are distributed across a

domain and whose local values can vary continuously with position or configuration. Gauge theories add a further distinction between differences in representation and differences in the represented physical state, while background-sensitive and background-independent formulations ask which structures are fixed in advance and which participate in the dynamics. The role of this section is to reconstruct these formal lineages without converting their physical origin into a social ontology. Its objective is to distinguish five resources that later GR and GRE may use selectively: field-based representation, local and distributed dependence, symmetry and gauge equivalence, the status of background structures, and methodological criteria for transferring physical formalisms into social analysis. The method is formal and genealogical. Each concept is introduced through the problem it solves in mathematics or physics, followed by a restrained account of what the concept can and cannot contribute to later generative-relational inquiry (Evans 2010; Jackson 1999; Yang and Mills 1954; Rovelli 2004).

These traditions matter because relational structure need not always be represented most naturally by a list of pairwise connections. Temperature varies across a body, electromagnetic quantities vary across spacetime, and continuum models represent density, velocity, pressure, or displacement through quantities attached to locations in a domain. A field description therefore asks how a quantity is distributed and how values at nearby or distant locations are related through differential, integral, or constraint equations. Gauge theory then shows that a formal description may contain degrees of freedom associated with representation rather than independently observable structure. General relativity and related work further demonstrate that some structures that function as fixed backgrounds in one theory can become dynamical variables in another. For GRE, the importance of these examples lies in the structural questions they make available: which conditions are distributed, which relations are local, which differences are representational, and which parts of a model have been treated as fixed before analysis begins.

### 2.34.1 Field-Based Representation

A field assigns a value or mathematical object to each point of a domain. In its simplest form, a scalar field assigns one number to each point; vector, tensor, spinor, and other fields assign richer objects. The domain can be physical space, spacetime, a manifold, or another configuration space appropriate to the problem. Field theories therefore differ from models whose principal objects are a finite collection of variables attached to discrete units. Their basic representational move is to make distributed variation itself the object of analysis.

A schematic scalar field can be written as a mapping

$$\phi : M \longrightarrow V, \quad x \longmapsto \phi(x), \quad (2.4)$$

where  $M$  is the domain and  $V$  is the space in which the field value lies. Equation 2.4 is intentionally generic. It does not say whether  $M$  is geographical space, spacetime, a material configuration, or an abstract state domain, and it does not specify whether  $\phi$  represents temperature, density, potential, stress, or another quantity. Its analytical



purpose is to distinguish a distributed assignment from a single system-wide variable.

Partial differential equations provide one of the principal mathematical languages for field evolution. Spatial derivatives encode how a field varies across nearby points, while time derivatives describe temporal change. Boundary conditions, source terms, constitutive relations, and initial conditions specify additional structure needed to determine solutions. The theory of partial differential equations is broad enough to include diffusion, wave propagation, fluid motion, elasticity, reaction–diffusion processes, and many other forms of distributed dynamics (Evans 2010). The common formal feature is not one physical ontology but a mode of representation in which local field values participate in a structured domain of variation.

Classical electromagnetism supplies a canonical example. Electric and magnetic fields assign quantities throughout space and time, and Maxwell’s equations relate their local variation to sources and to one another. Potentials provide another level of representation through which the same electromagnetic structure can be described (Jackson 1999). The field concept here does more than attach attributes to particles. A particle can move through a region whose electromagnetic conditions vary from point to point, and the relevant field exists in the model independently of whether a particle occupies every location. This is one reason field language became attractive far beyond its original domains: it offers a way to represent structured conditions surrounding or permeating localized entities.

That attraction requires conceptual discipline. A field in physics has a mathematically defined domain, codomain, transformation behavior, equations of motion, dimensions, and empirical interpretation. A social phrase such as “field of power,” “institutional field,” or “normative field” can be theoretically meaningful without sharing those properties. Section 50 already reconstructed social-field traditions whose explanatory logic concerns positions, stakes, dispositions, and structured arenas. The present section concerns a different lineage: mathematical and physical fields. Similar vocabulary creates opportunities for comparison, but terminological overlap does not establish formal equivalence.

A field representation can nevertheless support several kinds of social and economic modeling when its assumptions are explicit. Spatial economics can represent prices, population density, accessibility, pollution, land values, or productivity over geographical domains. Continuum models can approximate very large populations by densities rather than tracking each individual unit. Potential-like functions can summarize gradients that influence movement or adjustment. Mean-field methods can replace a complex collection of interactions with an effective aggregate influence under specified approximation conditions. Each use depends on substantive assumptions concerning continuity, scale, aggregation, locality, and measurement. The field formalism contributes a representation; the empirical domain determines whether that representation is defensible.

For GR and GRE, the main inheritance from field representation is therefore structural rather than ontological. It becomes possible to represent a condition that is distributed across a domain, to ask how local values vary, and to study how a change in one region propagates through an organized environment. This can be useful for later work on institutions, information environments, infrastructures, ecological constraints, or capability conditions when these are modeled as distributed rather than

purely actor-specific. Yet GR must still ask how the domain  $M$ , the field values  $V$ , and the meaning of location are constituted. In a social setting, a relevant “position” can be geographical, institutional, legal, informational, economic, or relational. The field formalism does not decide which space is the right one.

### 2.34.2 Local and Distributed Relational Conditions

Field theories sharpen a distinction between local dependence and distributed consequence. A local differential equation specifies how change at a point depends on quantities and derivatives evaluated at that point or in an infinitesimal neighborhood. Yet solutions of local equations can produce effects that extend across large regions because local interactions propagate through the domain. Locality therefore concerns the structure of the governing relation, while spatial extent concerns the behavior generated by repeated or continuous coupling.

This distinction is easy to blur in ordinary language. A process can be generated through local rules and still produce system-wide patterns. Diffusion offers a simple example: local gradients determine flux, but repeated local transport spreads a disturbance over a large region. Wave equations likewise describe propagation through local differential relations while permitting signals to travel substantial distances. Reaction–diffusion systems can combine local transformation with spatial coupling and thereby generate macroscopic pattern. The field perspective therefore provides a formal route from local relations to distributed organization without requiring a centralized coordinator.

Boundary conditions add another important layer. A field equation alone rarely determines a unique empirical configuration. Conditions at the edge of the modeled domain, interfaces between regions, source distributions, and initial states can materially affect the solution. Two systems governed by the same local differential operator can behave differently because their boundary conditions differ. This means that “local law” and “global organization” should not be identified. The local rule, domain geometry, boundary structure, source configuration, and initial condition jointly shape the realized field.

The distinction is relevant to economic and institutional inquiry because many processes combine local interaction with distributed constraint. A household can face locally observed prices whose formation depends on market-wide arrangements. A firm can respond to nearby suppliers while depending on infrastructures whose failure propagates across regions. Regulatory rules can apply at specific institutional interfaces while producing distributed effects through chains of compliance, finance, or information. Social norms can be encountered in local interaction yet reproduce broader patterned expectations. Field formalisms do not by themselves explain these processes, but they make a useful question explicit: is the relevant condition attached to an actor, to a dyadic relation, to a region of an underlying domain, or to a distributed structure extending across many locations?

Nonlocal models provide another caution. Not every distributed dependence is well represented by nearest-neighbor or infinitesimal coupling. Integral operators, long-range kernels, delayed interactions, and global constraints allow the state at one location to depend directly on conditions elsewhere. Effective theories can also con-

tain apparently nonlocal relations after unobserved degrees of freedom have been integrated out. The choice between local and nonlocal representation is therefore a modeling decision requiring evidence and scale awareness rather than a metaphysical preference.

The notion of locality becomes still more delicate outside physical space. If the domain is a network, an institutional hierarchy, a semantic space, or a configuration manifold, “nearby” refers to the geometry or topology of that representation. Two firms can be geographically distant yet adjacent in a supply network. Two legal categories can be close within a classification system while applying to actors in different jurisdictions. A field defined on such a domain inherits its locality from the chosen structure of the domain. Later GR can use this idea productively, but only if it specifies what relation makes two positions local.

Distributed conditions can also modify the capacities of localized actors without reducing those capacities to internal attributes. Access to transport, legal protection, information, credit, public goods, ecological quality, or institutional recognition can vary across a structured environment. A field-like model can represent such variation where continuity or another distributed structure is appropriate. This creates a bridge to the capability and relational-value traditions discussed earlier in the chapter: opportunities can depend on surrounding conditions as well as possessed resources. The formal field concept adds a possible representational vocabulary for patterned environments; it does not replace the normative or institutional theories needed to interpret those conditions.

For GRE, the inheritance is again precise. Field theories show how locally specified relations can generate distributed patterns and how background geometry, boundaries, sources, and coupling structure condition those patterns. They encourage analysis of economic environments that are neither reducible to individual attributes nor exhausted by pairwise networks. GR can extend the question by asking how the domain of locality itself changes: infrastructures alter effective distance, law changes which actors can interact, technologies reorganize information neighborhoods, and institutional reforms redraw boundaries. The relation that defines “local” can therefore be historically generated.

### 2.34.3 Symmetry and Gauge Equivalence

Symmetry introduces a different analytical problem. A transformation is a symmetry when it preserves specified structure. In geometry, mechanics, and field theory, symmetries can organize conservation laws, classify states, constrain admissible equations, or identify different mathematical descriptions that preserve relevant physical content. Gauge theory develops a particularly important case in which certain transformations alter the mathematical variables used in a description while leaving the represented physical situation unchanged in the relevant sense.

Electromagnetism provides an accessible example. The electromagnetic field can be expressed through potentials, but the potentials are not uniquely fixed by the observable field strengths. A gauge transformation changes the potential while preserving the electromagnetic field tensor. Schematically,

$$A_\mu \mapsto A_\mu + \partial_\mu \chi, \quad F_{\mu\nu} \mapsto F_{\mu\nu}, \quad (2.5)$$

where  $A_\mu$  is a potential,  $\chi$  is an admissible scalar function, and  $F_{\mu\nu}$  represents the gauge-invariant field strength. Equation 2.5 displays the essential distinction: a variable in the formal description changes while the gauge-invariant quantity remains the same. Gauge freedom is therefore not simply ordinary empirical variation. It reflects redundancy or equivalence in the representation of the physical state (Jackson 1999).

The twentieth-century development of gauge theory generalized this structure beyond electromagnetism. Yang and Mills formulated a theory invariant under local isotopic-spin rotations, introducing non-Abelian gauge fields whose dynamics are nonlinear (Yang and Mills 1954). Their construction became foundational for later particle physics. The historical importance for the present chapter lies less in the specific physical theory than in the conceptual architecture: demanding invariance under transformations that can vary from point to point changes the structure required of the theory and introduces connection-like objects that relate local descriptions.

Global and local symmetry should therefore be distinguished. A global transformation applies the same transformation throughout the domain. A local transformation permits the transformation to vary with position. Maintaining a suitable form of invariance under local transformations generally requires additional mathematical structure. Gauge fields and connections can be understood, at one level, as providing the machinery needed to compare or transport locally defined quantities consistently across neighboring points. The exact interpretation depends on the theory, but the broader lesson is that local representational freedom can constrain relational structure.

Gauge equivalence also clarifies a general epistemic distinction between observable difference and descriptive difference. Two formal configurations can look different because different gauges, coordinates, parameterizations, or conventions have been chosen while representing the same relevant physical state. The analyst must therefore identify which quantities are invariant under the transformations treated as representational redundancy. This is a more demanding task than merely noting that several descriptions exist. A gauge structure specifies the transformation group and the equivalence relation generated by it.

The concept is attractive for social analysis because social inquiry also encounters multiple descriptions, conventions, units, classifications, and coordinate systems. Yet the analogy can easily become too strong. Different monetary units can represent the same purchasing relation under a simple conversion, but changes in accounting categories, legal classifications, or social identities can also change behavior, rights, or institutional consequences. A transformation in description is socially gauge-like only if the transformation preserves the modeled substantive structure under explicitly stated conditions. The existence of several vocabularies does not itself create gauge equivalence.

This point is especially important for GR. Generative-relational inquiry is interested in equivalence, translation, representation, and the possibility that different descriptions preserve some relations while changing others. Gauge theory contributes

a rigorous precedent for separating representational redundancy from substantive variation. It also shows that equivalence is structured: one must specify the transformations under which invariance is claimed and the observables that remain unchanged. Later GR can generalize the question beyond physics by asking which institutional, economic, or epistemic transformations preserve a relational structure and which transformations generate a genuinely different one. The answer has to be established within each domain rather than imported from gauge theory.

Gauge ideas also caution against treating every formal variable as directly observable. Some variables are indispensable for calculation or local formulation while individual values depend on representational choice. In economics, latent variables, index constructions, numeraire choices, accounting conventions, and coordinate-dependent quantities can raise analogous questions, although the mathematical structure differs. A useful methodological inheritance is therefore to ask which conclusions are invariant under admissible changes of representation. Robustness across such transformations can reveal which results depend on arbitrary descriptive choices and which survive them.

The GRE bridge should remain modest. Gauge theory does not provide a ready-made model of institutions, value, or social identity. It provides an unusually developed example of how local representation, symmetry, equivalence classes, connections, and invariant quantities can be organized within one formal system. Those concepts can inspire rigorous questions about economic representation when an explicit transformation structure exists. Their value lies in analytical discrimination rather than metaphorical prestige.

#### 2.34.4 Background Dependence and Background Independence

Every formal model presupposes some structure. Coordinates, domains, metrics, boundary conditions, causal ordering, topology, probability spaces, admissible transformations, and measurement conventions can enter at different levels. A useful distinction concerns whether a structure is fixed in advance or included among the variables whose configuration is determined dynamically. In this sense, a *background* is not simply contextual information. It is structure that the theory presupposes rather than explains within the modeled dynamics.

Classical field theories often define fields on a fixed spacetime geometry. The geometry provides distances, causal relations, volume elements, and other structures used to formulate the field equations. The matter or gauge fields evolve, while the background spacetime is treated as given for the purpose of the theory. General relativity changes this arrangement in a fundamental way: spacetime geometry is represented by the metric field and participates in the dynamics rather than remaining a fixed stage. This feature motivates the language of background independence in gravitational theory and in approaches to quantum gravity (Rovelli 2004).

The distinction should be used carefully. Background independence is not exhausted by coordinate invariance, and general covariance alone does not guarantee that a theory contains no fixed background structure. A theory can be written in a coordinate-independent form while still presupposing nondynamical geometric objects. Conversely, practical calculations can introduce reference structures,



gauges, boundary conditions, or perturbative backgrounds without thereby changing the fundamental status of the underlying theory. The relevant question is which structures are fixed by the formulation and which are solved for, constrained, or transformed within it.

Background dependence is not intrinsically a defect. Models deliberately hold some conditions fixed in order to isolate a problem. A local labor-market model may treat national law as given; a firm model may treat currency institutions as given; an urban model may hold national borders fixed; a short-run macroeconomic model may treat technologies or demographic composition as parameters. These choices can be appropriate to the scale and purpose of inquiry. The methodological issue appears when a structure that materially changes during the process of interest is silently retained as fixed.

Economic theory repeatedly confronts this problem because its backgrounds are often institutional and historical. Property forms, accounting units, contractual enforceability, market boundaries, organizational categories, infrastructures, technologies, and legal personhood can be treated as conditions within one model while becoming objects of explanation in another. The same analytical object can therefore move between foreground and background depending on research scale. A price model can reasonably assume a market institution that a historical-institutional analysis seeks to explain.

This movement between levels has an important consequence for GRE. A model may be internally dynamic while remaining externally background-dependent in the sense relevant to the research question. Prices, quantities, or strategies can evolve endogenously while the rules defining admissible transactions remain fixed. A network can rewire while node identities and legal categories remain fixed. A field can evolve while its domain and metric remain fixed. Calling a model “dynamic” therefore says little about which of its constitutive conditions are themselves allowed to change.

Background sensitivity offers a useful intermediate language. An analysis can explicitly study how conclusions depend on the background structures it assumes even when those structures are not themselves dynamical variables. Sensitivity analysis can compare legal regimes, network architectures, spatial geometries, institutional constraints, or measurement conventions. Comparative institutional analysis likewise varies conditions that a narrower model would hold constant. This approach does not require a universal theory in which every background becomes dynamical at once. It requires the analyst to identify backgrounds and test which conclusions depend on them.

The generative-relational inheritance is strongest at this methodological level. GR repeatedly asks how the conditions that make a relation possible are themselves produced, maintained, altered, or removed. Background-independent physics supplies one striking precedent in which a structure once treated as fixed becomes dynamical. It does not imply that social institutions are analogous to spacetime geometry. The transferable question is more abstract: which elements of an explanation have been placed outside the process being explained, and what changes when one of those elements is brought inside the domain of transformation?

This question also guards against an impossible demand. No finite model explains

all of its own presuppositions simultaneously. Formal systems require languages, domains, inferential rules, data constructions, and boundary choices. GR should therefore not interpret generativity as a requirement for absolute backgroundlessness. A more defensible aim is reflexive background specification: identify which structures are fixed for a given inquiry, justify that choice, examine sensitivity where relevant, and permit previously fixed structures to become variables when historical evidence or the research problem requires it.

### **2.34.5 Methodological Limits of Physical Formalisms in Social Analysis**

Field, gauge, and background-sensitive formalisms offer powerful structural vocabularies, but their transfer into social and economic inquiry requires a stricter methodology than terminological analogy. The relevant question is not whether social reality can be described evocatively with words borrowed from physics. It is whether a formal construction specifies objects, relations, transformations, observables, and empirical conditions clearly enough to do explanatory or inferential work.

A first requirement concerns domain construction. A physical field is defined on a domain with specified mathematical structure. A social field model therefore needs an account of what counts as position and what geometry or topology relates positions. Geographic space may supply a direct answer in some applications. Institutional or relational spaces require a constructed metric, ordering, adjacency relation, or manifold-like representation. Without such structure, statements about gradients, locality, curvature, or propagation remain metaphorical.

A second requirement concerns measurement. Field values must correspond to estimable or operationally interpretable quantities if the formalism is intended for empirical analysis. A modeled “trust field,” “power field,” or “norm field” requires more than a suggestive name. The researcher must specify what is measured, how values are assigned, how uncertainty enters, and what observations would discriminate among competing field configurations. In theoretical work, unobserved fields can still be legitimate latent constructs, but their relation to observables must eventually be articulated if empirical claims are made.

A third requirement concerns dynamics and coupling. Borrowing a field variable without specifying an evolution equation, interaction rule, or constitutive relation often adds notation without adding explanation. If an actor state is said to couple to a surrounding field, the model should state how the field affects the actor and how, if at all, actors affect the field. Linear, nonlinear, local, nonlocal, delayed, and stochastic couplings have different consequences. The choice should reflect a substantive mechanism rather than aesthetic resemblance to a physical theory.

A fourth requirement concerns symmetry. Gauge language is justified only when a transformation class has been specified and when the relevant substantive quantities are invariant under that class. Changing a label, currency unit, coordinate chart, accounting convention, or normalization can sometimes function in this way. Other changes alter institutional meaning or causal consequences and therefore cannot be treated as mere gauge. The formal discipline of gauge theory is valuable precisely because it prevents equivalence from being asserted loosely.

A fifth requirement concerns background structure. Social models inevitably fix

some institutions, categories, scales, and boundaries. The important methodological task is to identify them. A model becomes more reflexive when it states which conditions are exogenous for the present inquiry, which are dynamical, and which may need to change status at another scale or historical period. Background independence in physics should therefore be treated as a source of conceptual questions rather than a standard that every social model must imitate.

A sixth requirement concerns ontology. Successful mathematical representation does not by itself establish that the represented social object is literally a physical field, gauge connection, manifold, or spacetime. Several mathematically inequivalent models can fit the same observations, and one formalism can often approximate systems with very different underlying mechanisms. The book's standing commitment to ontological suspension is especially important here. Formal structures should be evaluated by explanatory clarity, empirical adequacy, inferential value, and compatibility with the domain rather than by the prestige of their physical origin.

These limits do not reduce the importance of the lineage. They clarify what can be inherited responsibly. Field theories contribute methods for representing distributed conditions and continuous variation. Locality distinguishes immediate coupling from system-wide consequence. Gauge theory supplies a rigorous language for representational equivalence, local symmetry, and invariant quantities. Background-sensitive reasoning distinguishes what a model allows to vary from what it presupposes. Together, these concepts expand the formal repertoire available to relational economic analysis beyond discrete topology alone.

They also illuminate several later GR questions. A relational configuration may depend on conditions distributed across an institutional or informational environment. The effective meaning of locality may be generated by infrastructure, law, or communication technology. Different descriptions may preserve some relational structure while changing representational coordinates. Conditions initially treated as background can become objects of historical transformation. GR can formulate these problems without claiming that social reality obeys the same equations as a gauge field theory or gravitational theory.

For GRE, the most useful inheritance is therefore methodological reflexivity about representation. A formal model should reveal what its entities are, where they live, which relations are local, which transformations preserve the modeled structure, which quantities are invariant, and which backgrounds have been held fixed. These questions help prevent relational language from becoming vague precisely because they force the analyst to declare the architecture of the representation.

This prepares the next lineage. Field and gauge formalisms clarify how structure can be distributed, locally related, representationally redundant, and background-sensitive. They do not by themselves answer how information is quantified, how computation constrains inference, how simulations generate knowledge, or how symbolic systems mediate formal representation. Section 64 therefore turns to information, computation, and formal representation, where the focus shifts from the geometry and invariance of modeled structure to the encoding, transformation, and epistemic limits of representations themselves.

## 2.35 Information, Computation, and Formal Representation

Field, gauge, and background-sensitive formalisms clarify how a model can represent distributed conditions, locality, invariance, equivalence, and dependence on fixed or dynamical backgrounds. Information theory and computation shift attention toward another layer of formal inquiry: how distinctions are encoded, transmitted, transformed, and operationalized within symbolic systems. The role of this section is to reconstruct the principal intellectual resources connecting information, computation, simulation, and scientific representation before Section 65, *Generative Relational Theory*, turns explicitly to generative relational theory. Its objective is to distinguish five analytical problems that are often compressed into a general vocabulary of “information” or “computation”: probabilistic information and entropy, effective computation and resource complexity, simulation as a mode of scientific inquiry, symbolic representation and model construction, and the relation between computational limits and broader epistemic limits. The method is formal and philosophy-of-science oriented. Mathematical concepts are introduced only where their technical content matters, and their transfer to social and economic inquiry remains subject to the book’s standing commitments to methodological pluralism and ontological suspension (Shannon 1948; Turing 1937; Winsberg 2010).

The resulting lineage is important because formal representation does more than provide notation for already given objects. A computational analysis requires choices about variables, data structures, categories, admissible operations, initial conditions, stopping rules, and criteria of comparison. Information theory measures selected statistical properties of messages without supplying their semantic or normative interpretation. Computability theory distinguishes procedures that can in principle be carried out mechanically from problems for which no such general procedure exists. Complexity theory adds the further question of how computational resources grow with problem size. Simulation makes formally specified systems experimentally manipulable within computational environments, while philosophy of modeling clarifies that a model represents selected aspects of a target for specific purposes rather than reproducing the target in full (Hartmanis and Stearns 1965; Giere 2004). These distinctions supply GRE with disciplined resources for computational inquiry while preserving a central epistemic caution: what can be encoded or computed is determined partly by the representation through which the inquiry has been constructed.

### 2.35.1 Information and Entropy

Modern information theory gives the term *information* a precise statistical meaning. Shannon’s communication theory was formulated around the transmission of messages generated by a source through a channel, including the effects of noise, redundancy, coding, and channel capacity (Shannon 1948). Its mathematical achievement depends on restricting the problem. The theory asks how uncertain a message source is, how efficiently messages can be encoded, and under what conditions signals can be transmitted reliably. The semantic significance of the message to a receiver is not part of the quantity measured by Shannon entropy. This restriction is foundational

for later interdisciplinary use because it prevents statistical information from being treated automatically as knowledge, meaning, relevance, truth, or value.

For a discrete random variable  $X$  taking possible values  $x_i$  with probabilities  $p_i$ , Shannon entropy is stated in Equation 2.6.

$$H(X) = - \sum_i p_i \log p_i. \quad (2.6)$$

Equation 2.6 measures uncertainty associated with the probability distribution. When one outcome is nearly certain, entropy is low; when probability mass is distributed more evenly across several possible outcomes, entropy is higher. The numerical unit depends on the logarithm's base. A base-two logarithm measures entropy in bits. The quantity therefore concerns the expected informational content associated with distinctions among possible messages under a specified probability model. It does not by itself measure the importance of a message, the credibility of a source, the truth of a proposition, or the social consequences of receiving it.

This distinction matters because ordinary language uses *information* across several layers. A statistical event can reduce uncertainty while conveying little practical importance. A highly consequential statement can be unsurprising and therefore have low surprisal under an appropriate probability distribution. A false message can possess Shannon information because its statistical rarity is independent of its truth. A coded signal can be transmitted with high fidelity while its receiver lacks the interpretive resources required to understand it. Information theory therefore establishes one rigorous concept of information while leaving semantic, epistemic, pragmatic, and normative dimensions to other theories.

Entropy should also be handled carefully when moved among domains. Shannon deliberately adopted a mathematical form related to entropy expressions already used in statistical physics, and later work has developed deep connections between information theory and statistical mechanics. Yet the existence of formal correspondence does not make thermodynamic entropy, communication entropy, institutional uncertainty, and social disorder interchangeable concepts. A valid transfer requires a specified probability space, random variable, coding problem, or other formal object to which the entropy measure applies. Describing a society as having “high entropy” without such a construction usually functions as analogy rather than measurement.

Related information-theoretic quantities extend the same statistical architecture. Conditional entropy represents remaining uncertainty about one variable when another is known. Mutual information measures statistical dependence by quantifying how much knowledge of one variable reduces uncertainty about another. Channel capacity concerns reliable communication under constraints and noise. These quantities can be useful in economics, networks, learning systems, and computational social science because they can summarize dependencies that need not be linear. Their interpretation nevertheless remains representation-dependent: the analyst has already decided what the variables are, which observations count as possible states, how probabilities are estimated, and which distinctions are retained or discarded.

This makes information theory especially relevant to relational inquiry without turning information into a universal social substance. A relation between measured



variables can carry mutual information; a communication network can be analyzed in terms of signal transmission; an institution can constrain the range of possible messages or actions observed in a dataset. These are legitimate formal uses when the statistical objects are specified. A richer relational claim—for example, that an actor understands another, recognizes an obligation, acquires practical knowledge, or experiences a change in trust—requires additional semantic and social theory.

The distinction also clarifies a recurring issue in economic measurement. Prices, classifications, ratings, indicators, and records can function as information-bearing signals, but their informational role depends on institutional arrangements and interpretive conventions. A price may summarize dispersed conditions while also being generated by rules of exchange, market structure, strategic action, legal rights, and measurement practices. A credit score can reduce uncertainty for a lender while shaping the opportunities of the person classified. The amount of statistical information conveyed by such objects is analytically separable from the justice, meaning, or performative consequence of the classification.

GRE can therefore inherit information theory at a precise level. It gains tools for studying uncertainty, coding, dependence, transmission, compression, and noise. These concepts become especially useful when later research examines knowledge infrastructures, AI systems, market signals, institutional records, or distributed coordination. The stronger GR question concerns how the variables and distinctions over which information is defined become historically constituted. A probability distribution presupposes a sample space; an information channel presupposes identifiable messages, encodings, senders, receivers, or state distinctions. Generative-relational inquiry can place the formation and revision of those distinctions within the object of study while retaining the technical contribution of information theory where its assumptions are satisfied.

### 2.35.2 Computation and Complexity

Computation adds a different formal question: which transformations can be carried out by an effective mechanical procedure? Turing's analysis of computable numbers supplied a mathematical model of such procedures through abstract machines operating on symbols according to finitely specified rules (Turing 1937). The importance of this lineage lies in the separation between intuitive calculability and formally characterized computation. Once a class of mechanical procedures is represented with sufficient precision, the theory can establish both positive results concerning what can be computed and negative results concerning problems for which no general effective procedure exists.

The universal-machine idea further changes the relation between machine and task. A single machine architecture can, given an appropriate symbolic description, simulate the behavior of other machines. Program and data thereby become representable within a common computational medium. This conceptual move became foundational for general-purpose digital computation. It also supplies a useful distinction for later formal modeling: the physical computing substrate, the encoded procedure, the input representation, and the target process being modeled occupy different analytical layers even when they interact in practice.

Computability should be distinguished from computational complexity. A problem can be computable in principle while requiring resources that grow so rapidly with input size that exact calculation becomes impractical. Hartmanis and Stearns helped establish computational complexity as a systematic study of the resources required to compute, explicitly distinguishing the existence of a procedure from the difficulty of carrying it out (Hartmanis and Stearns 1965). Time, memory, communication, parallel depth, approximation error, and other resource measures can define different notions of computational difficulty. The resulting classification concerns algorithms relative to formal input specifications and computational models.

This distinction is especially important in economic and social modeling. An equilibrium, optimum, matching, policy schedule, network statistic, or inference problem may be mathematically well-defined without being efficiently computable at the relevant scale. A theoretically specified decision rule can therefore impose computational demands that actual agents could not satisfy. Algorithmic institutions—auctions, platforms, recommendation systems, allocation mechanisms, risk engines, or automated bureaucratic procedures—also face computational constraints of their own. The economics of information and decision-making can consequently depend on the cost of computing, storing, searching, communicating, and verifying representations rather than only on the logical existence of a solution.

Computational complexity is also distinct from complexity in the sense developed in Section 61. Complex-systems research concerns interacting components, emergence, adaptation, nonlinearity, multiscale organization, and coevolution. Computational complexity concerns resources required by algorithms or formal problems. A complex adaptive system can sometimes be simulated by a computationally inexpensive model, while a formally simple problem statement can induce severe computational demands. Shared terminology should therefore not collapse two different research traditions.

The formalization of computation introduces its own representational dependencies. An algorithm receives inputs in an encoded form and produces outputs according to specified operations. Changing the encoding can alter practical performance and sometimes the apparent size of the problem, although robust complexity theory seeks classifications that survive reasonable changes of representation. In empirical work, further choices arise before the algorithm begins: which observations become variables, how missingness is represented, which categories are distinguished, how continuous quantities are discretized, and which losses or constraints define successful output. Computational analysis inherits these choices rather than replacing them.

This point becomes particularly important for AI and computational economics. Increased computational capability can enlarge the class of models, searches, optimizations, or simulations that are practically accessible. It does not automatically improve the quality of the represented problem. A powerful optimizer can efficiently solve a misspecified objective. A classifier can consistently reproduce a historically generated labeling scheme. A large simulation can explore a formal state space that omits decisive institutional or normative distinctions. Computational power and epistemic adequacy therefore constitute different dimensions of inquiry.

At the same time, formal computation contributes a valuable discipline to theories of agency. Economic models often describe actors as choosing, learning, forecasting,

or optimizing. Computational perspectives ask which procedures could realize those capacities, what information the procedures require, and how resource bounds alter behavior. Bounded rationality, heuristic search, algorithmic markets, and machine-mediated institutions all become easier to formulate once the cost and structure of computation are treated as substantive features rather than invisible background conditions.

For GRE, the inheritance is again layered. Computability theory establishes limits on general mechanical procedure; complexity theory characterizes resource demands among computable procedures; practical computing adds architecture, approximation, numerical stability, data access, and implementation constraints. These resources help distinguish a theoretical possibility from an executable institutional mechanism. Later GR can add another question: how do the computational tasks themselves arise, change, or disappear as institutions redefine objectives, categories, available data, and relations among actors? A change in the represented problem can matter as much as a change in the algorithm used to solve it.

### 2.35.3 Simulation and Computational Experiment

Computer simulation turns formal models into executable processes whose behavior can be explored through systematic variation. The analyst specifies a model, initializes it under selected conditions, executes its update procedures, records outputs, and compares outcomes across parameter settings, interventions, stochastic realizations, or alternative model structures. Simulation thereby creates a distinctive mode of scientific practice situated between mathematical deduction, numerical approximation, empirical observation, and experimental manipulation. Philosophy of simulation has emphasized that its evidential role depends on the relations among theory, model construction, numerical methods, code, validation, calibration, and target-world evidence (Winsberg 2010).

A computational experiment differs from a laboratory experiment because the immediate object being manipulated is a formal or computational system. Changing a simulated tax rule, network topology, climate forcing, disease parameter, or agent strategy changes the model run. Whether the resulting variation supports a claim about the target system depends on the empirical and theoretical warrant connecting model and target. This distinction preserves the scientific importance of simulation while avoiding the inference that a result generated by code has thereby been observed in the world.

Simulation is especially valuable when analytical solutions are unavailable or when interaction produces behavior that is difficult to derive from component rules by inspection. Agent-based modeling provides a clear social-scientific example. Epstein and Axtell construct artificial societies in which heterogeneous agents interact under explicit local rules so that aggregate patterns can be studied as computational outcomes (Epstein and Axtell 1996). Section 61 used this tradition to clarify a constructive meaning of emergence. The present section adds an epistemic distinction: computational generation can demonstrate that a specified mechanism is sufficient to produce a pattern within a model, while additional evidence is required to establish that the mechanism generated the corresponding historical pattern in the target

world.

This difference between generative sufficiency and empirical identification is central. Several distinct models can produce qualitatively similar aggregate outcomes. Parameter combinations can compensate for one another. A simulated macro-pattern can remain robust while the micro-mechanisms generating it vary. Conversely, a model can fit historical data because parameters were calibrated closely to those observations while performing poorly outside the calibration domain. Simulation therefore creates evidence through a chain of warrants rather than through visual resemblance between output and observation alone.

Validation has several layers. Verification concerns whether the computational implementation correctly solves or executes the specified model. Validation in the stronger empirical sense concerns whether the model is adequate for the target and purpose. Sensitivity analysis studies how outputs depend on parameters, initial conditions, stochastic seeds, numerical approximations, or structural assumptions. Calibration links parameter choices to observations. Out-of-sample comparison, replication, alternative specifications, and mechanism-specific evidence can further strengthen or weaken the interpretation. These procedures do not reduce simulation to a single universal protocol; they identify distinct questions that must be answered for different inferential purposes.

Simulation also changes what counts as accessible evidence. Some models contain quantities that are difficult or impossible to observe directly in empirical systems but are completely recorded inside the simulation. The analyst can inspect every agent state, counterfactual branch, network tie, or intermediate variable if the program has been constructed to expose them. This epistemic abundance can be useful while creating a potential asymmetry: the simulation is more observable than the target. Explanations derived from internal simulated variables therefore require a bridge back to measurable or otherwise warranted features of the real system.

Computational experimentation can serve purposes beyond prediction. It can test the internal consequences of assumptions, reveal unexpected interactions, compare mechanisms, explore possible regimes, identify sensitivity, generate hypotheses, study counterfactuals, and expose where a verbal theory remains underspecified. Winsberg's analysis of simulation emphasizes the distinctive epistemic practices through which computational models mediate theory and evidence rather than functioning as transparent deductions from first principles (Winsberg 2010). In social inquiry, this is especially important because the act of formalization often forces assumptions about timing, interaction, information, and institutional structure to become explicit.

The capacity to experiment computationally does not make the represented social world closed under the model's rule set. Real actors learn from representations, contest categories, reinterpret rules, create institutions, and change technologies. A simulation can represent such reflexivity when corresponding processes are included, but the model remains bounded by its implemented state variables and transition mechanisms. Open-ended novelty poses a particular challenge because a finite computational model usually defines in advance at least the language through which novelty can appear, even when the realized sequence of events is unpredictable.

GRE can inherit simulation as an important methodological instrument without treating simulation as its privileged method. Historical archives, ethnography, legal interpretation, surveys, experiments, econometrics, network analysis, formal proof, and computational models answer different questions. Simulation becomes especially useful when GRE wants to examine how specified relational mechanisms generate trajectories, how interventions interact with network or institutional structure, or how heterogeneous agents and fields coevolve under explicit rules. The evidential status of the resulting outputs depends on the purpose of the model and on the quality of the bridge between formal construction and historical-economic target.

#### 2.35.4 Symbolic Representation and Model Construction

Computation operates on representations. Variables, symbols, categories, data structures, equations, graphs, matrices, ontologies, program states, and model objects make selected distinctions available to formal manipulation. Section 37 reconstructed philosophical traditions in language, interpretation, and symbolic mediation. The present subsection focuses on the scientific and computational consequence of that inheritance: a model does not contain its target directly. It contains a structured representation through which particular aspects of a target can be described, transformed, compared, or simulated.

Cassirer's philosophy of symbolic forms provides an important philosophical precursor to this view by treating symbolic articulation as constitutive of intelligible experience rather than as a transparent duplication of a fully formed world (Cassirer 1955). Scientific modeling develops the issue in a more domain-specific way. Giere argues for a pragmatic relation in which scientists use models to represent selected aspects of the world for particular purposes, with the relevant representational relation depending on designated similarities and the aims of inquiry (Giere 2004). This formulation helps avoid two extremes: models are neither exact copies of reality nor arbitrary constructions unconstrained by evidence.

Selective representation is unavoidable. A macroeconomic model may retain output, inflation, employment, and interest rates while suppressing household identities and legal details. A network model may retain nodes and ties while omitting the semantic content of interactions. An agent-based model may encode several heterogeneous traits while holding institutional categories fixed. A machine-learning system may transform persons, texts, images, or transactions into feature vectors. Each representation creates an analytical surface on which some distinctions become computable and others disappear.

Formalization therefore involves more than assigning symbols to pre-existing facts. The analyst defines equivalence classes, scales, categories, units, temporal resolution, missing-value rules, boundaries, and admissible transformations. Two historical events can become instances of one variable because the model treats certain differences as irrelevant. Several institutional arrangements can be grouped under one category. A continuous phenomenon can be discretized. A relation can be represented as binary, weighted, signed, directed, temporal, multilayer, or higher-order. These choices can be justified and empirically productive while remaining theoretically consequential.



This representational selectivity is closely related to the background problem introduced in Section 2.34. A model background specifies what remains fixed while other quantities vary. A symbolic representation goes one step earlier by determining what can appear as a quantity in the first place. Some features of a target are variables, others parameters, others boundary conditions, and still others remain absent. Computational execution cannot recover a distinction that the representation never encoded unless the system is supplied with additional data or a mechanism for constructing a new representational category.

Representation also has a syntactic dimension. Formal systems define permissible expressions and operations. A graph permits questions about adjacency and paths once objects have been encoded as nodes and relations as edges. A probability model permits questions about distributions and conditional dependence once outcomes and events are defined. A program permits state transformations expressible through its data types and operations. Syntax enables systematic transformation precisely because it constrains what counts as a well-formed object. The scientific question is whether these constraints preserve the distinctions relevant to the intended target and purpose.

Semantics enters when formal objects are interpreted. A variable named “trust” is mathematically just a variable until the model states what empirical, behavioral, survey, institutional, or theoretical content the quantity is meant to represent. A network edge named “influence” requires a criterion for identifying influence. A latent factor receives substantive meaning through a relation among measurement model, evidence, and theory. Symbolic labels can therefore create an illusion of semantic completeness when the interpretive bridge has not actually been established.

Pragmatics adds a third layer. The adequacy of a representation depends partly on what the model is being used to do. A coarse model can be adequate for estimating aggregate energy demand and inadequate for evaluating distributive justice. A binary network can be sufficient for identifying disconnected components and insufficient for analyzing the intensity or legal character of relationships. Giere’s purposive account of representation is useful here because representational adequacy is assessed relative to selected aspects and scientific purposes rather than through an impossible requirement of total resemblance (Giere 2004; Giere 2006).

These choices acquire additional significance in social and economic systems because classifications can become causally active. A category used for taxation, credit, welfare eligibility, employment status, migration, or risk assessment can alter the opportunities and behavior of the persons classified. The representation then participates in the target system rather than remaining an external description. A computational classification system can change incentives and institutional practice; those responses can modify the data from which later models are trained or evaluated. Representation can therefore enter feedback with the reality it represents.

This possibility does not eliminate the distinction between model and world. It makes the relation historically dynamic. A classification may begin as an administrative representation and later become a strategic object around which actors organize. A metric can become a target. A platform’s internal data model can reshape how transactions are offered or recorded. A legal category can create a new capacity or restriction. These processes are especially important for GRE because economic

infrastructures increasingly embed formal representations directly into decision systems.

The GR inheritance from symbolic representation is consequently deeper than a claim that reality is constructed by language. Formal and symbolic systems create selective interfaces through which phenomena become recordable, comparable, computable, and governable. Their categories can remain purely analytical in one context and acquire institutional force in another. Later generative-relational analysis can therefore study both directions of mediation: relations and practices produce representations, while stabilized representations can reorganize later relations and practices. The conceptual contribution of the representation lineage is to keep the model, the target, the interpretive mapping, and the use of the model analytically distinct even when they become causally coupled.

### 2.35.5 Computational Limits and Epistemic Limits

The formal limits of computation provide powerful results, but they define only one part of the wider limits of knowledge. Turing's work establishes that a sufficiently general theory of effective computation encounters problems for which no universal mechanical decision procedure exists (Turing 1937). Complexity theory adds cases in which a procedure exists while required resources become prohibitive as problem size grows (Hartmanis and Stearns 1965). Numerical analysis, finite precision, stochastic approximation, and hardware constraints add further practical limitations. These are computational limits in different senses and should be distinguished from empirical underdetermination, measurement error, semantic ambiguity, model misspecification, historical novelty, or normative disagreement.

A first distinction separates undecidability from intractability. An undecidable problem lacks a general algorithmic solution within the relevant formal framework. An intractable problem can be computable while exact solution demands excessive time, memory, or other resources for instances of practical interest. Approximation, heuristics, decomposition, randomized methods, or problem-specific structure can make difficult computations usable without changing the underlying theoretical classification. Statements about "impossibility" should therefore identify which type of limit is meant.

A second distinction separates computational difficulty from data limitation. An algorithm can be efficient while the required input is unavailable, unreliable, biased, or conceptually ill-defined. Estimating a social parameter can be computationally easy and empirically weak because the construct is poorly measured. Conversely, rich and reliable data can be available for a task whose optimal solution is computationally difficult. Data abundance and computational tractability are independent dimensions.

A third distinction concerns identifiability and underdetermination. Several models can fit the same observations while implying different mechanisms or counterfactuals. Additional computation can explore these alternatives more thoroughly, but computational power alone does not create discriminating evidence. Section 32 treated underdetermination as an epistemic problem concerning the relation among evidence, representation, and competing explanations. Computation can help char-

acterize the space of compatible models while leaving the evidential ambiguity intact.

A fourth distinction concerns representation. A computational system solves the problem encoded for it. If the representation omits a relevant relation, confounds distinct categories, assumes a fixed boundary that later changes, or operationalizes a normative concept inadequately, exact computation can produce a precisely calculated answer to an ill-posed question. The epistemic limit then arises before computation, in the construction of the formal object. This is one reason symbolic representation belongs in the same lineage as computation rather than being treated as a cosmetic preprocessing step.

A fifth distinction concerns semantic and interpretive limits. Information-processing systems can manipulate symbols or statistical patterns without sharing the human practices through which those symbols acquire institutional, historical, ethical, or experiential meaning. Some computational approaches can model semantics, infer latent structure, or learn representation from data, but the evidential status of the resulting representation still depends on how it is connected to a domain of interpretation. Successful prediction can establish a useful regularity without resolving every question about meaning or causal mechanism.

A sixth distinction concerns reflexivity. Social actors can learn about a model, respond strategically to a metric, redesign institutions, change classifications, or alter behavior because a prediction has been published. The target can therefore change partly because it has been represented. Computational models can include reflexive responses when they are specified, but the possibility complicates any assumption that the data-generating process remains fixed across observation and intervention. This is a historical and institutional problem in addition to a computational one.

These distinctions qualify several common inferences. More computational power does not imply proportionately more knowledge. A formally undecidable question does not imply that every practically relevant question in the domain is unknowable. Computational intractability does not establish normative indeterminacy. Predictive accuracy does not by itself establish causal explanation or justice. A transparent symbolic model can be epistemically weak if its assumptions are false, while a computationally opaque model can still provide useful evidence under appropriately tested conditions. Evaluation requires attention to the local epistemic task.

The converse is equally important. Formal limits can reveal genuine constraints that philosophical reflection alone might overlook. A policy design that presupposes an exact solution to an intractable optimization problem may be institutionally unrealistic. A decentralized mechanism can distribute computation differently from a centralized one. Approximation quality can affect distributive outcomes. Communication constraints can limit coordination even when actors share objectives. Verification costs can shape which claims or transactions are institutionally acceptable. Computational architecture can therefore become part of political-economic structure.

GRE can use these insights to analyze economies increasingly mediated by algorithms, databases, platforms, automated decision systems, and AI. Computational capacity is itself distributed unevenly across actors. Some organizations can collect more data, train larger models, simulate more alternatives, or execute decisions at

greater speed than others. Those asymmetries can become sources of economic capability and power. Yet the analysis must distinguish the possession of computation from the possession of justified knowledge. An actor can compute at scale while operating with biased categories, incomplete observations, unstable objectives, or strategically produced data.

The generative-relational implication concerns the coevolution of representation, computation, and target. A model is built from distinctions generated within a historical setting; computational use can stabilize or amplify those distinctions; institutional responses can alter the environment; later data then reflect both the original world and the consequences of earlier representations. This recursive structure does not eliminate formal analysis. It identifies an expanded object of analysis in which formal systems participate in the relations they measure and govern.

Section 64 therefore completes the scientific and formal lineage developed across Sections 59–64. Systems and cybernetics contributed feedback, regulation, self-organization, and adaptation. Dynamical systems supplied state spaces, trajectories, attractors, bifurcations, and time-dependent change. Complexity research added emergence, multiscale organization, adaptation, and coevolution. Network and higher-order formalisms represented structured interaction and changing topology. Field and gauge approaches clarified distributed conditions, invariance, equivalence, and background sensitivity. Information and computation add encoding, uncertainty, effective procedure, resource limits, simulation, and the epistemology of formal representation. These traditions do not converge automatically into one theory. They provide a repertoire of partially compatible analytical resources whose assumptions and domains must remain visible.

The next step can therefore be stated with greater precision. Generative relational theory does not begin from an absence of predecessors. It emerges within a dense field of philosophical, social-theoretical, economic, dynamical, computational, and representational lineages. Section 65 turns to GR itself by clarifying ontological suspension, the relation between relational and representational layers, the meaning of generative relational systems, the use of fields and trajectories in generative space-time, and the possibility that the rules and relations producing later transformation can themselves become objects of transformation.

## **2.36 Generative Relational Theory**

The preceding sections reconstructed philosophical, social-theoretical, economic, normative, dynamical, network, field-theoretic, informational, and computational resources that make a generative relational research programme intellectually available. The role of the present section is different. It turns explicitly to Generative Relational Theory (GR) and states the minimum conceptual architecture required for the later construction of Generative Relational Economics (GRE). The objective is to identify a provisional synthesis whose components remain open to revision as they are tested across domains, while keeping inherited concepts distinguishable from GR's own programmatic claims. The discussion proceeds through five elements: ontological suspension; the distinction and interaction between relational and representa-

tional layers; the concept of a generative relational system; fields, trajectories, and generative spacetime; and historical transformation of the rules through which later states and relations are generated. The method is synthetic and programmatic. Concepts inherited from earlier traditions retain their local meanings and limitations, while GR specifies how selected resources can be organized into a common research architecture without treating theoretical translation as identity.

GR begins from a methodological priority rather than a universal metaphysical proposition. Many phenomena of interest to economics and the social sciences are constituted, sustained, modified, or rendered effective through relations among heterogeneous participants, institutions, material conditions, symbolic systems, and historical processes. Relational analysis therefore asks how apparently stable entities acquire and maintain their properties within configurations of dependence, recognition, constraint, exchange, interpretation, and interaction. Generative analysis adds a second question: how do those configurations produce later entities, relations, capacities, constraints, meanings, values, and possibilities, including changes in the mechanisms of generation themselves? The combined programme treats relations as historically consequential and generation as recursively relational.

The word *generative* carries a specific burden in this framework. It does not refer simply to production, creativity, novelty, or causal influence. A process is generative in the stronger GR sense when its operation participates in producing the conditions, structures, distinctions, capacities, or relational configurations through which subsequent processes become possible. Generation can stabilize existing forms, open new possibilities, close existing possibilities, redistribute capacities, or alter the criteria through which later events are interpreted. The concept is therefore temporally extended and historically situated. What a relation generates can appear at another scale, after a delay, through mediation, or through cumulative reinforcement rather than as an immediate output.

The resulting theory is deliberately incomplete at this point in the book. Chapter 4 develops its ontological position in detail; Chapters 6–9 translate the framework into research praxis and methodology; Chapters 12–15 reconstruct specifically economic architectures, value processes, and generative spacetime. Section 2.36 therefore supplies a constitutional bridge within the intellectual genealogy: it states enough of GR to show what GRE inherits, while reserving stronger ontological, epistemic, methodological, and domain-specific claims for the chapters where they can be developed and evaluated directly.

### 2.36.1 Ontological Suspension

Ontological suspension is the first discipline of GR because relational inquiry frequently encounters heterogeneous kinds of entities whose ultimate ontological status is disputed or irrelevant to the local research question. Persons, organizations, states, legal persons, markets, algorithms, currencies, classifications, institutions, ecosystems, and mathematical representations do not obviously share one mode of being. A framework that required prior resolution of their ultimate metaphysical status would often make substantive inquiry depend on controversies that the inquiry itself is not equipped to settle. GR therefore suspends stronger ontological commitment where



such commitment is unnecessary to the analytical task.

Suspension has a positive methodological meaning. It permits the researcher to ask whether a configuration is relationally produced, sufficiently persistent, causally or institutionally effective, recognizable within a domain, and capable of participating in subsequent relations without first identifying its ultimate metaphysical substance. This stance extends the minimal relational criterion introduced earlier in Section 2.11: a social or economic configuration can possess analytical reality through stable participation in consequential relations even when its deeper ontological interpretation remains contested. Chapter 4 later distinguishes ontological, relational, and manifestational registers more fully.

Ontological suspension differs from ontological denial. GR does not claim that metaphysical questions are meaningless, that ultimate ontology is inaccessible in principle, or that every ontological account is equally adequate. It makes a narrower commitment concerning research order. Where several ontologies are compatible with the observed relational structure and where the substantive argument does not require a choice among them, the choice can remain open. Where an empirical or normative claim does depend on ontology—for example, claims concerning consciousness, moral patienthood, biological individuality, or legal responsibility—suspension cannot substitute for domain-specific argument.

The same discipline applies to formal representation. Section 2.34 showed that field, gauge, and background-sensitive formalisms can organize distributed conditions, equivalence classes, and dependence on representational backgrounds. Section 2.31 showed that state spaces, trajectories, attractors, and bifurcations can organize temporal change. GR may use these resources without inferring that the social world is literally a physical field, a manifold, or a dynamical system of a single predetermined type. Formal success supports a representation relative to a research problem; it does not by itself settle the ontology of the represented domain.

Ontological suspension also supports interdisciplinary comparison. Economics may represent an organization as a producer, law as a juridical person, sociology as a structured collectivity, organizational theory as a decision system, and political theory as a locus of authority. These descriptions can overlap without becoming mutually reducible. GR asks which relations, capacities, constraints, and effects each representation makes visible, and where translation across representations succeeds or fails. The framework thereby preserves pluralism while permitting comparison at the level of relational organization.

A second consequence concerns historical variation. Ontological categories used in social inquiry can themselves be institutionally stabilized. The legal corporation, the modern household, the citizen, the employee, the platform account, and the algorithmic agent acquire practical boundaries and capacities through historically specific arrangements. Ontological suspension prevents analytical categories from being naturalized prematurely. It keeps open the possibility that a category appearing entity-like at one historical moment is sustained through relations whose reorganization can transform the category itself.

For GRE, this methodological restraint is especially important because economic inquiry routinely crosses material, institutional, symbolic, computational, and nor-

mative domains. Money can be represented as a unit of account, a legal relation, a medium of exchange, a balance-sheet position, or an institutionalized claim. Value can appear through prices while exceeding price. Productive capacity can depend on human skill, technical infrastructure, legal permission, ecological conditions, and computational access. Ontological suspension allows these heterogeneous components to enter one relational analysis without assuming that they share a common metaphysical substance.

The practical limit of suspension should remain explicit. A theory cannot suspend every commitment simultaneously. Any analysis selects entities, distinctions, temporal boundaries, evidence, and relations. GR therefore treats ontological suspension as disciplined minimization of unnecessary commitment rather than absence of commitment. The next problem is consequently representational: once the researcher adopts a provisional relational description, how should the relation between the represented processes and the representation itself be understood?

### 2.36.2 Relational and Representational Layers

GR distinguishes relationally effective processes from the representations through which researchers, institutions, and participants describe them. The distinction is analytical rather than absolute. A representation can remain external to the processes it records, or it can enter the domain as a classification, metric, rule, prediction, legal category, price, score, or model that later affects conduct. The framework therefore requires both separation and possible recursion between relational and representational layers.

The *relational layer* contains the configurations being analyzed at the level relevant to the research question: participants, relations, structures, constraints, capacities, resources, institutions, material conditions, and processes of change. This language does not imply that each component is ontologically primitive. A participant can itself be relationally constituted, a constraint can be institutionally generated, and a boundary can be maintained through recurrent practices. The layer is defined by analytical role: its components participate in producing the phenomena under investigation.

The *representational layer* contains the observational, classificatory, symbolic, statistical, computational, legal, linguistic, or formal objects through which some features of relational processes become available for interpretation or intervention. Data sets, variables, categories, diagrams, equations, narratives, accounting identities, administrative classifications, and machine-learned representations all belong here when they function as representations. Section 2.35 established why representation cannot be reduced to neutral transcription. Representations select some distinctions and suppress others, and the adequacy of those selections depends on the purpose and evidential conditions of inquiry.

GR adds a historical relation between the two layers. Representations are generated within relational settings. Statistical categories depend on institutions of measurement; legal classifications depend on juridical practices; economic indicators depend on accounting conventions and data infrastructures; scientific models depend on research communities, instruments, and interpretive standards. Representation is therefore itself a relational achievement. Its categories can stabilize because orga-

nizations reproduce them, because infrastructures encode them, or because participants coordinate around them.

The reverse relation is equally important. A stabilized representation can return to the relational layer and modify later interaction. Credit scores affect access to credit. Performance indicators alter organizational incentives. legal classifications confer or withdraw capacities. Market forecasts influence expectations. Platform metrics reorganize visibility. Scientific categories can structure research and policy. In such cases, representation becomes one component of the relations whose later state it helps to generate. The distinction between layers remains conceptually useful precisely because causal coupling does not erase difference of function.

This recursive possibility provides one bridge between epistemology and political economy. A representation can distribute advantages and constraints when institutions act through it. The question is then wider than whether the representation is descriptively accurate. Researchers can ask who produces the category, whose characteristics become visible, what forms of uncertainty disappear from the representation, which actors can contest it, and how its institutional use changes subsequent relations. Representational power arises when the capacity to define or operationalize a category participates in structuring the domain represented.

GR also distinguishes manifestation from representation, although the full distinction belongs to Chapter 4. A phenomenon can manifest through observable effects without yet being symbolically represented; representation can then organize those manifestations into named or formalized objects. Several relational structures can produce similar manifestations, while one relational structure can manifest differently across contexts. Reverse inference from representation to underlying relation is consequently limited. The framework treats non-invertibility as a recurring epistemic problem rather than assuming transparent access from observable form to generative structure.

The layered view also prevents a recurrent confusion in formal modeling. A graph used to represent a social network is not identical to the social relations represented by its edges; a state vector is not identical to the historical system summarized by its coordinates; an estimated field is not identical to the institutional or material conditions it encodes. These distinctions remain important even when the formal model predicts successfully. The representation is evaluated through its mapping to evidence, its inferential purpose, its robustness, and its consequences of use.

At the same time, GR resists placing the representational layer wholly outside the system. Researchers, models, classifications, and measurements can themselves be participants in the history they study. The scope of the system therefore depends on the research question. A macroeconomic model may initially treat its publication as external to the modeled economy; a study of expectation formation may need to include publication and reception within the relational process. A legal model can treat a category as given for one task and study the historical production of the same category for another.

This variable boundary is central to GR's methodological flexibility. Layers are research distinctions whose adequacy must be justified locally. They organize inquiry without imposing a universal two-level ontology. What matters is that the analyst can

state which processes are being represented, what the representation selects, how the mapping is justified, and whether representational artifacts participate in subsequent relations. Once this distinction is established, the framework can define more precisely what makes a system *generative relational*.

### 2.36.3 Generative Relational Systems

Relational theories already challenge explanations that isolate entities from the relations through which their properties and capacities are constituted. GR extends this orientation by placing the generation of later relational conditions at the center of analysis. A generative relational system is therefore characterized less by a fixed inventory of elements than by the patterned processes through which entities, relations, capacities, constraints, structures, and possibilities are produced, maintained, transformed, or dissolved over time.

**Definition 2.1** (Generative relational system). A *generative relational system* is an analytically bounded configuration in which relations among participants, structures, constraints, capacities, material conditions, and symbolic or institutional forms contribute to producing the conditions of subsequent states and relations. The definition permits the identities of participants, the topology and kinds of relation, relevant constraints, system boundaries, and the effective rules of transformation to change historically when the domain provides evidence for such change.

Definition 2.1 contains two commitments that distinguish GR from a merely relational description. The first is temporal: relations are studied through what they make possible later, not only through the properties they exhibit at one moment. The second is reflexive at the level of structure: some outcomes of a relational process can become inputs or conditions for later relational processes. An institution generated through earlier interaction can constrain later interaction; a trust relation can change the probability and cost of subsequent cooperation; a classification can become embedded in infrastructure; accumulated capital can reshape bargaining power; a technological standard can reorganize the space of feasible designs.

Generation should be distinguished from simple succession. The fact that one state follows another does not establish a generative relation. GR requires an account of the mechanisms, pathways, constraints, or enabling conditions through which an earlier configuration contributes to a later one. Depending on the domain, evidence can be historical, comparative, experimental, statistical, interpretive, computational, or formal. Methodological pluralism is essential because generative relations can operate through meanings and institutions as well as material transfers and measurable interactions.

Generation should also be distinguished from immediate causation. A relational configuration can generate a capacity without determining when that capacity will be exercised. It can generate a constraint whose effects appear only under later conditions. It can alter a probability distribution, a feasible set, a network topology, a legal status, or an interpretive repertoire rather than directly producing one observed event. Delayed, latent, cumulative, and cross-scale effects therefore belong within the generative vocabulary when the mediating relations are specified.

The concept permits stabilizing and destabilizing generation. A system can repro-

duce a recognizable structure through recurrent interaction, as in institutional routines, market conventions, or organizational roles. It can also produce transformations that weaken the relations responsible for earlier reproduction. Generativity therefore carries no presumption of growth, improvement, creativity, or desirability. Exploitation, exclusion, ecological degradation, institutional lock-in, and the destruction of future capacities can be generative processes in the technical GR sense because they alter the conditions of later possibility.

This neutrality is important for normative analysis. GRE later evaluates how generative processes distribute capacities, risks, value, participation, and future options, but the descriptive concept of generation precedes the judgment. A self-reinforcing hierarchy can be strongly generative while normatively objectionable. A just institutional arrangement can be normatively attractive while dynamically fragile. Keeping these dimensions distinct allows later justice analysis to ask which generative structures ought to be sustained, transformed, constrained, or dismantled.

GR also treats system boundaries as analytical and potentially historical. Classical systems analysis often gains explanatory power by specifying a system and environment. GR preserves that discipline while allowing the boundary itself to become an object of inquiry. A firm can internalize a function previously performed by a market; a platform can redefine which participants count as users or workers; a state can extend or retract legal jurisdiction; a supply chain can reorganize across national borders. Boundary transformation changes which relations are treated as internal, external, or constitutive.

The participants in a generative relational system need not remain fixed either. New organizational forms can emerge, legal statuses can be created, technical agents can enter an economic process, and previously separate collectivities can become institutionally integrated. The framework therefore distinguishes an entity's persistence from the persistence of the relations that constitute its effective identity. Stable subjecthood can itself be a generated achievement, as Sections 2.13 and 2.11 prepared through relational theories of subject formation and social reality.

A further distinction concerns scales. Generative effects can move upward, downward, and laterally across analytical levels. Repeated local interaction can stabilize an institution; institutional constraints can reorganize individual incentives and capacities; transnational infrastructures can alter local opportunity structures; local innovation can propagate through networked adoption. GR does not assume that macrostructure is reducible to microinteraction or that macrostructure acts independently of the relations that reproduce it. The analytical task is to identify the mechanisms connecting scales and the temporal conditions under which those connections persist.

The notion of a generative relational system is therefore intentionally broader than a specific mathematical model. Network models can represent topology, dynamical systems can represent trajectories, field models can represent distributed conditions, agent-based models can represent heterogeneous interaction, and institutional analysis can reconstruct rules and meanings. Different representations may be appropriate to different parts of the same generative process. GR supplies a common problem structure—relation, generation, historical transformation, scale, and representation—rather than prescribing one universal formalism.

### 2.36.4 Fields, Trajectories, and Generative Spacetime

GR requires concepts that can represent distributed conditions and temporally extended transformation without reducing historical processes to isolated events. Fields, trajectories, and generative spacetime provide three complementary resources for this purpose. Each is inherited from a different formal or scientific lineage, and each is used under ontological suspension. Their value lies in the analytical distinctions they make possible rather than in a claim that social reality literally possesses the structure of a physical field or relativistic spacetime.

A *field* in GR is a representation of conditions that vary across a specified relational, spatial, institutional, or otherwise structured domain. The field can encode opportunity, constraint, salience, risk, accessibility, institutional pressure, resource availability, or another quantity for which a distributed representation is analytically warranted. Section 2.34 established the methodological burden: the domain, field variable, notion of locality, coupling, and evidential interpretation must be specified. Field language is useful when the condition facing an actor depends on position within a structured environment rather than solely on pairwise relations.

The field perspective also supports interaction between actors and environment. Participants can respond to distributed conditions while their actions alter those conditions. Infrastructure can change accessibility; investment can alter productive capacity; collective exit can weaken an institution; public communication can change a field of salience; law can modify the constraints distributed across a jurisdiction. A field can therefore be both a condition of action and an outcome of accumulated action. The representation becomes generative when present field conditions participate in producing later relational configurations and when those configurations can in turn transform the field.

A *trajectory* represents the ordered history of a relational configuration through a chosen analytical space. Section 2.31 supplied the dynamical distinction between a state and a path through states. GR broadens the research use of this distinction by allowing trajectories of relations, institutions, capacities, classifications, resources, and values in addition to trajectories of conventional state variables. Historical sequence matters because the same observable condition can be reached through different paths whose accumulated commitments, latent capacities, or institutional memories differ.

Trajectory analysis also creates a natural place for irreversibility and hysteresis. A relation dissolved at one time need not be reconstructable at the same cost later. A capability lost through prolonged disinvestment may require years to rebuild. Institutional trust can decay rapidly and recover slowly. Ecological thresholds can foreclose prior production possibilities. Historical events can therefore alter the future option space even when a later observable variable returns to an earlier numerical level. GR treats these path-dependent differences as substantive objects rather than residual complications around a static equilibrium.

The term *generative spacetime* combines these temporal and relational concerns into a broader analytical representation. It is designed for domains in which what can affect what, when, through which pathways, and across which distances cannot be captured adequately by chronological time and geographic space alone.



**Definition 2.2** (Generative spacetime). A *generative spacetime* is a research representation of events and processes in which temporal order, historical depth, relational distance, spatial organization, causal or generative accessibility, and changing constraints are analyzed together in order to study how present configurations open, transmit, delay, amplify, redirect, or foreclose later possibilities.

Definition 2.2 is intentionally plural in its dimensions. Geographic distance can matter for transport, ecological exposure, or jurisdiction. Network distance can matter for information diffusion. Institutional distance can matter for access to authority. Epistemic distance can matter for translation across communities. Legal time, technological time, organizational time, and generational time can move at different rates. Generative spacetime is therefore not a single metric space given in advance. Its structure must be constructed for the research problem and justified by the mechanisms under investigation.

The concept also permits heterogeneous presents. Two actors occupying the same chronological moment can inhabit very different effective temporal positions because their infrastructures, institutions, technologies, legal statuses, accumulated resources, or historical exposures differ. A new technical capability can be immediately accessible to one organization and practically unreachable to another. A legal reform can take effect formally at one date while institutional implementation unfolds unevenly across regions or populations. Generative analysis therefore studies synchrony and misalignment rather than presuming a homogeneous present.

Causal and generative accessibility is another central dimension. Some potential relations are technically possible yet institutionally blocked. Others are legally permitted but economically inaccessible. Some effects require long chains of mediation and arrive only after substantial delay. A change can be locally strong while unable to propagate across a boundary. Generative spacetime provides a vocabulary for studying reachability, delay, blockage, amplification, and path dependence together, while leaving the specific formalization to the domain and evidence.

This representation is especially important for economic analysis because production, value, capability, and power unfold across different scales and times. Capital investment can reorganize future production long after the transaction. Educational capacity develops over years. Infrastructure fixes spatial possibilities for decades. Financial decisions propagate rapidly through networks. Ecological degradation can accumulate slowly and become difficult to reverse. Later GRE chapters use generative spacetime to place these heterogeneous temporalities and relational distances within one analytical programme without reducing them to a single clock or metric.

Fields, trajectories, and generative spacetime therefore supply a language for conditions, histories, and accessibility. Their shared limitation is equally important: each representation can still presuppose a rule for how change occurs. GR's strongest generative question arises when the effective rule itself becomes historically variable.

### 2.36.5 Historical Transformation of Generative Rules

The transformation of generative rules is the point at which GR moves beyond analysis of changing states under a stable mechanism. Section 2.31 distinguished autonomous dynamics, time-dependent dynamics, and changes in the conditions gov-

erning trajectories. Sections 2.32 and 2.33 added adaptation, coevolution, and changing interaction topology. GR generalizes the research question: under what conditions do the mechanisms that generate later relations, categories, constraints, and possibilities themselves become products of historical processes?

A useful analytical sequence distinguishes several levels of change. A *state change* modifies the values of variables while preserving the represented relations and rule. A *relational change* adds, removes, or changes relations among participants. A *parameter change* alters coefficients or conditions within a specified rule. A *structural change* modifies topology, constraints, boundaries, or available degrees of freedom. A *rule change* modifies the mapping through which current configurations generate later ones. These categories can overlap empirically, but separating them reduces the risk of describing an observed transformation prematurely as a change in the generative rule.

The distinction can be represented schematically while leaving open whether a particular empirical GR problem admits this formalization. Let  $\mathcal{G}_t$  denote the relational configuration represented at time  $t$ , let  $\Gamma_t$  denote the effective generative rule used by the model, and let  $\eta_t$  collect contextual conditions not represented inside  $\mathcal{G}_t$ . A coupled representation of configuration change and rule change is stated in Equation 2.7.

$$\begin{aligned}\mathcal{G}_{t+\Delta t} &= \Gamma_t(\mathcal{G}_t, \eta_t), \\ \Gamma_{t+\Delta t} &= \Psi_t(\Gamma_t, \mathcal{G}_t, \eta_t).\end{aligned}\tag{2.7}$$

Equation 2.7 performs a limited analytical task. Its first line represents change generated under the effective rule at time  $t$ . Its second line allows the rule used for later generation to change through a process represented by  $\Psi_t$ . The equation does not establish that a social system literally contains an explicit meta-rule  $\Psi_t$ , nor does it guarantee that the analyst knows the space of possible future rules. It identifies a modeling distinction between evolution under a rule and evolution of the effective rule.

Historical social systems provide several mechanisms through which such rule transformation can occur. Institutions can revise the procedures that govern participation. Legal reforms can create new rights, liabilities, organizational forms, or transaction possibilities. Technologies can introduce actions that did not previously exist within the relevant option space. Collective learning can change norms of interpretation and coordination. Infrastructure can alter which relations are feasible. Political struggle can change who possesses authority to define the rules. Environmental change can render an earlier production rule materially impossible. The generative mechanism is therefore often distributed across institutional, material, symbolic, and strategic relations.

Rule transformation can also arise from outcomes generated by the earlier rule. A market structure can produce concentrations of capital that enable firms to alter regulation or platform architecture. A classification system can generate populations organized around the classification, creating pressure for revision. A technological

standard can produce complementary investments that make later standards difficult to adopt. An educational system can generate expertise that changes the system's own curriculum and research capacities. In each case, earlier relational outputs become conditions of later rule formation.

Reflexivity makes the problem more demanding. Participants can form representations of the system, anticipate rules, and act in ways that preserve or transform them. A legal rule can be strategically tested. A metric can be gamed. A forecast can change behavior. A movement can deliberately attempt institutional transformation. Generative rules in social inquiry therefore differ from immutable natural laws when the rule refers to institutions, conventions, classifications, or strategic arrangements that participants can contest. GR treats this distinction as a domain property to be investigated rather than a reason to abandon formal analysis.

Evidence for rule transformation requires caution. An observed break in a time series can reflect a shock, parameter change, measurement revision, unobserved heterogeneity, or model misspecification rather than a transformed generative mechanism. Historical documentation can reveal explicit institutional redesign, while comparative evidence can show that similar states generate different outcomes under different regimes. Structural estimation, change-point methods, network analysis, qualitative process tracing, archival work, and computational modeling can contribute different forms of evidence. The evidential adequacy of these methods remains domain-dependent, and claims of rule transformation require triangulation appropriate to the case.

The possibility of rule transformation also places a limit on prediction from historical regularity. A model estimated under one regime can remain locally useful while becoming unreliable after the relations generating the data have changed. The problem is stronger than ordinary parameter drift when the relevant variables, categories, or action possibilities are themselves reconstituted. GR therefore treats model validity as historically situated. A representation adequate to one generative regime can require revision when the regime transforms.

This point does not imply that historical systems lack durable regularities. Stable institutions, material constraints, path dependence, and self-reinforcing relations can make some generative mechanisms persistent over long periods. Indeed, identifying the conditions of persistence is one purpose of GR. The framework adds the complementary question of what would have to change for the mechanism itself to change, and which relations make that transformation more or less accessible.

For governance, the distinction is consequential. Intervention can target an immediate state, a relation, a parameter, a constraint, a capacity, an institutional boundary, or the generative rule through which later outcomes are produced. These targets differ in reversibility, delay, evidential burden, distributional consequence, and risk. Later chapters develop this distinction within application-dominant praxis. At the present genealogical stage, the important point is conceptual: generative relational analysis gives rule transformation an explicit place among the possible objects of inquiry.

Section 2.36 can now be summarized without treating GR as the inevitable convergence of the traditions reviewed earlier. Ontological suspension supplies methodolog-

ical restraint. Relational and representational layers distinguish effective processes from the forms through which they are observed and governed while permitting recursive feedback between them. Generative relational systems make the production of later relational conditions central. Fields and trajectories provide representations of distributed conditions and historical paths, while generative spacetime integrates temporal order, relational distance, and accessibility. Historical transformation of generative rules extends analysis from change within a structure to change in the mechanisms that produce later structure.

These components form the minimum GR architecture required for GRE, but they leave substantial theoretical problems unresolved. Relation can be interpreted differently across philosophical and social traditions. Emergence, reproduction, adaptation, and generation do not share one established definition. Value and justice introduce normative dimensions that dynamical and informational formalisms do not supply. Formal equivalence can coexist with substantive disagreement about ontology or meaning. The next section therefore turns from synthesis to the limits of synthesis, identifying recurrent convergences while preserving unresolved differences among the intellectual lineages from which GR and GRE draw.

## **2.37 Convergences and Unresolved Theoretical Problems**

The intellectual genealogy reconstructed across this chapter contains several recurrent problem forms, yet recurrence does not establish theoretical identity. Philosophies of relation, social theories of embedded action, process traditions, evolutionary economics, regenerative thought, theories of value and justice, and scientific formalisms often approach overlapping questions from different ontological, explanatory, normative, and methodological positions. The role of this section is to identify those partial convergences while preserving the disagreements that remain consequential for Generative Relational Theory (GR) and Generative Relational Economics (GRE). Its objective is therefore diagnostic rather than unificatory. The discussion compares four recurrent problem families—relation, generation, value, and formal representation—and then identifies the unresolved work required to connect them without converting translation into equivalence.

The method follows the discipline established at the beginning of the chapter. A convergence is treated as a shared analytical problem, a partially compatible distinction, or a mutually informative research orientation. It is not treated as evidence that the contributing traditions share one ontology or explanatory mechanism. Similar vocabulary can conceal different theoretical commitments, while different vocabulary can sometimes organize closely related problems. The task is consequently to compare the work performed by concepts within their home traditions and to identify which parts remain transportable into a generative relational programme.

This distinction is particularly important because GR sits close to several already mature intellectual traditions. Its relational orientation overlaps with philosophical accounts of internal and constitutive relation, relational sociology, field theory, institutional analysis, and network science. Its temporal orientation overlaps with process philosophy, historical materialism, evolutionary economics, path-dependence

research, complexity science, and dynamical systems. Its concern with value and justice overlaps with political economy, capability approaches, relational-value scholarship, feminist economics, and normative theory. Its formal interests overlap with systems, networks, fields, dynamical models, information theory, and computational simulation. These overlaps provide resources and impose constraints. GR gains conceptual depth from them only when inherited differences remain visible.

The resulting picture is one of structured incompleteness. Relation does not by itself explain generation. Generation does not determine what has value. Value does not supply a dynamical mechanism. Formal representation does not establish the ontology or normativity of the represented domain. GR therefore requires coordination among several analytical registers whose integration remains a research programme rather than a completed theorem. Section 2.37 makes that incompleteness explicit before the final section of the chapter states the more specific theoretical position of GRE.

### 2.37.1 Relation across Philosophical and Social Traditions

Relation is the most persistent convergence across the traditions reviewed in this chapter, but it is also among the most internally differentiated. Philosophical treatments ask whether relations are external to independently constituted terms, internal to what the terms are, structurally prior to some properties, or themselves dependent on relata that must be characterized independently. Cassirer's movement from substance concepts toward functional concepts and Whitehead's process-relational metaphysics represent strong attempts to relocate explanatory priority away from self-sufficient substances, while analytic debates over internal and external relations retain a more differentiated field of possibilities (Cassirer 1923; Whitehead 1929). Section 2.9 therefore resisted a universal relation-first ontology and treated relation as a family of philosophical problems concerning constitution, dependence, structure, and higher-order organization.

Social theory approaches relation through another route. Relational sociology criticizes explanations that attribute social action and identity exclusively to pre-given substantial actors, emphasizing transactions, positions, networks, fields, and patterned interdependence instead (Emirbayer 1997). Bourdieu's field-oriented sociology similarly analyzes practices through relations among positions, distributions of capital, and historically constituted fields rather than through isolated individual attributes (Bourdieu and Wacquant 1992). Institutional economics and economic sociology add rules, conventions, embeddedness, trust, authority, and organizational structure. Recognition theory, theories of subject formation, and legal-institutional analysis further show that some socially effective identities and capacities depend on relations of recognition, classification, authorization, and participation.

These approaches converge on a modest but consequential claim: many properties relevant to social and economic explanation become intelligible only when the relations through which they are constituted or exercised are included in the analysis. Bargaining power depends on alternatives and institutional positions. Creditworthiness depends partly on classificatory and informational arrangements. Organizational authority depends on recognized roles and procedures. Productive capacity

depends on access to infrastructures, skills, technologies, and complementary participants. The explanatory unit therefore often extends beyond an isolated bearer of a property.

The convergence weakens when stronger ontological claims are introduced. A philosophical thesis that relations are metaphysically fundamental differs from an empirical claim that relational variables improve explanation in a specified social domain. A network representation that places edges between nodes can remain compatible with substantial assumptions about node identity. A field theory can make positions relational without claiming that persons possess no properties outside the field being studied. A legal analysis can show that corporate personality is institutionally constituted while leaving biological personhood outside its scope. GR inherits the analytical priority of relation under these differentiated conditions rather than treating them as one doctrine.

A second unresolved issue concerns the individuation of relata. Relational analysis commonly begins with participants whose identity is sufficiently stable for the research task. Generative relational analysis asks when that identity itself becomes historically produced. The difference matters because a relation among already specified firms is analytically different from a process through which mergers, law, technology, or classification produce new kinds of economic actor. Similarly, a relation among occupational categories differs from a historical process that changes the categories themselves. GR therefore needs criteria for deciding when entity identity can be treated as given and when it must become part of the generative explanation.

A third issue concerns the scale and type of relation. Dyadic interaction, network adjacency, institutional dependence, symbolic classification, material coupling, legal obligation, shared infrastructure, field position, and interpretive relation can all be important, yet they are not interchangeable. Their causal pathways, evidence, temporal durability, and normative significance differ. Higher-order relations add another layer: relations can depend on other relations, and configurations can acquire properties that are not attributable to one tie in isolation. The network and hypergraph traditions reviewed in Section 2.33 offer formal resources for some of these structures, while interpretive and institutional relations often require additional qualitative or historical reconstruction.

A fourth issue concerns relational persistence. A relation can be episodic, repeated, institutionally stabilized, technologically embedded, legally codified, or reproduced through expectation. These modes of stabilization generate different kinds of durability. Treating them under a common relational vocabulary remains useful only if the mechanisms of persistence stay visible. The same caution applies to dissolution: relations can weaken through non-use, strategic exit, institutional reform, infrastructural change, conflict, reinterpretation, or the disappearance of one participant. A general relational theory therefore needs a differentiated account of how relations begin, persist, transform, and end.

GR's convergence with relational traditions is consequently strongest at the level of research orientation. Entities, properties, and actions can require relational reconstruction; relations themselves can possess history; and the configuration of relations can alter what later relations become possible. The unresolved problem is to develop a sufficiently rich taxonomy of relational kinds and mechanisms without turning "re-



lation” into an explanatory placeholder. GRE later inherits this problem in concrete form because economic relations include exchange, ownership, labor, credit, care, governance, dependence, cooperation, competition, ecological interdependence, and symbolic valuation, each of which requires domain-specific specification.

### 2.37.2 Generation across Process, Evolutionary, and Regenerative Traditions

Generation forms a second convergence across traditions concerned with process, emergence, reproduction, evolution, adaptation, and regeneration. Process philosophy emphasizes becoming and event over an exclusively static ontology, while theories of emergence analyze the appearance of organized properties that require explanation at a level or configuration different from the components considered independently. Evolutionary economics studies variation, selection, retention, innovation, routines, and coevolution as mechanisms through which economic structures change historically (Nelson and Winter 1982; Nelson 1994). Path-dependence research shows how sequences of earlier events can alter later costs and possibilities. Regenerative thought asks how productive and ecological practices can participate in renewing capacities and conditions rather than merely extracting or recirculating existing stocks (Reed 2007).

The common orientation is temporal and productive in a broad sense. Present configurations participate in producing later configurations, and historical sequences matter because the conditions of later action are partly inherited from earlier processes. This convergence supports the GR emphasis on temporally extended consequence. A relation can matter because it changes a capacity, creates an institution, stabilizes a convention, modifies an ecology, redistributes resources, or reorganizes the feasible space in which later actors operate. The object of explanation is therefore often a transformation in conditions rather than an immediate output alone.

Important distinctions remain. Process describes becoming without necessarily specifying a mechanism of selection or retention. Emergence concerns the appearance or organization of properties and does not by itself establish a generative pathway. Evolutionary models require particular accounts of variation, selection, inheritance, learning, routines, or coevolution and should not be generalized into a synonym for historical change. Reproduction concerns the maintenance or renewal of conditions across time and can preserve structures that are unequal or destructive. Regeneration frequently carries a substantive orientation toward renewed ecological or social capacity, whereas GR uses generation descriptively before normative evaluation. These traditions therefore contribute different temporal grammars.

The distinction between generation and improvement is especially important. Evolutionary persistence can result from selection under historically specific conditions without implying normative superiority. Self-reinforcing mechanisms can stabilize exploitation, exclusion, ecological damage, or concentrated power. Regenerative design explicitly introduces evaluative criteria concerning the restoration or enhancement of capacities, while GR’s more general category of generativity includes processes that create, reproduce, diminish, or destroy later possibilities. This descriptive neutrality is required if GRE is to study both generative benefit and generative harm.

Generation also differs from reproduction. Reproduction can maintain a recognizable organization through recurrent processes. Generation can produce continuity, but it can also produce qualitative novelty, new participants, new relations, or new rules. A labor regime may reproduce class relations while also generating new technical capacities. An educational system may reproduce inequality while generating knowledge. A platform may reproduce market dominance while generating new categories of work and new data infrastructures. These mixed effects make it difficult to assign one generative character to a whole system without specifying the object, scale, time horizon, and affected population.

A further unresolved problem concerns novelty. A process can generate a state that is new relative to the immediately preceding state without generating a new category of entity or relation. Stronger novelty arises when available action types, institutional categories, interaction topologies, or interpretive schemes change. Section 2.36 treated rule transformation as the strongest version relevant to the present framework, while also warning that observed discontinuity does not automatically establish transformation of the generative rule. GR therefore needs operational distinctions among ordinary state change, relational change, structural change, and transformation in the mechanisms that produce later states.

Temporality introduces another difficulty. Generative effects can occur at different delays and scales. A transaction may produce an immediate allocation and a delayed change in bargaining position. Infrastructure can generate capacities over decades. Ecological degradation can accumulate gradually before becoming visible as constraint. Institutional trust can emerge from repeated interaction and then alter the cost of future coordination. A generative explanation must therefore specify the temporal window within which effects are attributed and the mechanisms that connect events across that window. Otherwise, distant consequences can be attached to an earlier relation without sufficient evidential discipline.

The process, evolutionary, and regenerative traditions converge most strongly around the refusal to treat current structure as historically self-explanatory. Their unresolved integration concerns the mechanisms and criteria through which one kind of historical production can be distinguished from another. GR responds by reserving “generative” for processes that help produce later conditions of possibility, while leaving the specific mechanism to empirical and domain-specific analysis. GRE will need this distinction because economic production, reproduction, innovation, capability formation, accumulation, ecological renewal, and institutional transformation can intersect while remaining analytically different processes.

### **2.37.3 Value across Economic and Normative Traditions**

Value creates a third zone of convergence and tension. Economic traditions have treated value through labor, utility, scarcity, exchange, price, production, and social form. Philosophical and pragmatist traditions distinguish forms such as intrinsic, instrumental, final, and relational value and examine valuation as a practice through which objects, actions, and states become appraised (Dewey 1939; E. Anderson 1993). Capability approaches shift attention from resources alone toward substantive opportunities and functionings, thereby connecting economic arrange-

ments to what persons are effectively able to do and be (Sen 1999). Relational-value and relational-goods traditions identify goods or values that arise through forms of association rather than through isolated possession. Justice theory adds questions concerning distribution, procedure, recognition, equality, domination, and the institutional conditions of social relations (Rawls 1999; E. S. Anderson 1999).

The convergence lies in the inadequacy of treating all economically relevant value as a single homogeneous magnitude. Price provides indispensable information within market settings, yet price and value remain analytically distinguishable. Care, trust, ecological capacity, institutional legitimacy, knowledge, cultural meaning, social recognition, and future opportunity can participate in economic life without being adequately represented by one price measure. Conversely, assigning a non-market value to something does not imply that the value can be compared cardinally with other valued objects on a common scale. GRE therefore inherits value pluralism together with the burden of specifying which value concept is operative in a particular analysis.

Several levels should remain distinct. Valuation is a process through which value is attributed or recognized. Economic price is an institutional outcome generated through particular market arrangements. Normative value concerns what has worth under an ethical or evaluative account. Relational value concerns worth that depends constitutively on a relation or form of association. Capability concerns substantive opportunity rather than the valuation of an object alone. Justice evaluates distributions, procedures, relations, and institutional conditions under normative criteria. These concepts can interact without collapsing into a common metric.

The unresolved problem of commensurability follows directly. Economic decision often requires comparison among alternatives, while plural values may resist full reduction to one scale. Cost-benefit analysis, price signals, multicriteria methods, democratic deliberation, rights constraints, and institutional rules provide different mechanisms for making decisions under heterogeneous values. None of these mechanisms automatically settles the philosophical question of whether the underlying values are commensurable. GRE will therefore need to distinguish practical decision procedures from claims of value equivalence.

Power enters valuation because institutions shape which values become visible, measurable, exchangeable, compensable, or authoritative. Unpaid care can be socially necessary while weakly represented in market accounts. Ecological loss can remain external to transaction prices. Cultural and relational goods can be damaged by institutional changes that increase measured output. Conversely, symbolic or reputational value can be monetized through new infrastructures. A generative relational theory of value must therefore study the relations through which valuation criteria are formed and the consequences of those criteria for subsequent allocation and recognition.

Temporal extension makes the problem still harder. A process can create present value while degrading future capacity; another can impose present cost while expanding later capability. Intergenerational relations, infrastructure, education, ecological regeneration, and knowledge production all require value judgments across time. Discounting, rights, capability preservation, sustainability constraints, and regenerative criteria offer different approaches, yet they encode different normative

commitments. A generative perspective adds the question of how present arrangements reshape the future space within which value can later be produced, perceived, and realized.

The notion of generative justice reviewed in Section 2.29 contributes an especially relevant bridge because it directs attention toward circulation, participation, return, and the capacity of communities to generate value rather than treating justice solely as the distribution of completed outputs (Eglash 2016). GR broadens the generative question beyond one established normative framework, while GRE can retain the insight that justice may concern access to value-generating relations and infrastructures as well as shares of existing goods. The normative criteria for evaluating those relations, however, still require argument from justice theory rather than derivation from generativity itself.

The central unresolved integration is therefore triangular. Economic analysis identifies processes through which resources, goods, prices, and productive capacities are organized. Normative theory evaluates institutions and relations under criteria of justice and worth. Generative analysis traces how present arrangements produce later capacities, constraints, values, and opportunities. These three tasks can inform each other, but none can substitute for the others. GRE requires a vocabulary capable of linking them while preserving their different evidential and justificatory burdens.

#### 2.37.4 Formal Representation across Scientific Traditions

The scientific and formal traditions reviewed in Sections 2.30–2.35 provide a fourth field of convergence. Systems and cybernetics contribute feedback, regulation, openness, and adaptation. Dynamical systems contribute state spaces, trajectories, stability, attractors, and bifurcations (Strogatz 2024). Complexity science contributes emergence, heterogeneous interaction, multiscale organization, and adaptive dynamics (Holland 2012). Network and multilayer approaches represent relational topology and changing patterns of connection (Newman 2003; Kivelä et al. 2014). Field formalisms represent distributed conditions and local variation. Information theory and computation contribute precise measures and limits for coding, transformation, algorithmic procedure, and simulation (Shannon 1948; Turing 1937). Philosophy of modeling and simulation clarifies the mediated relation between formal representation and target system (Giere 2004; Winsberg 2010).

These traditions converge in their capacity to represent organized dependence. They permit analysis to move beyond isolated variables toward patterns of interaction, temporal evolution, distributed conditions, multiscale effects, and computational constraints. They also make distinctions that ordinary prose can obscure. A node is distinguishable from an edge; a state from a trajectory; a parameter change from a bifurcation; a local field value from a global configuration; a Shannon measure from semantic content; a computable procedure from a tractable one. GR benefits from these distinctions because relational and generative claims otherwise risk becoming too elastic to test.

Formal convergence, however, remains representational rather than ontological. The same empirical system can often be represented through more than one formalism. A supply network can be studied as a graph, a dynamical system on a graph, a

multilayer network, an agent-based model, or a system of coupled flows. Different representations foreground different features. The existence of multiple useful models therefore supports methodological pluralism and model comparison more readily than it supports a unique formal ontology.

A related issue concerns equivalence. Two mathematical representations can be equivalent under a transformation while carrying different empirical interpretations. Conversely, two empirically similar phenomena can require formally different models because their mechanisms differ. Gauge equivalence supplies one technically precise example of representational redundancy, but its social-scientific analogues require independent justification. GR should therefore treat “same structure” as a claim whose criterion must be stated: isomorphism, homomorphism, simulation relation, observational equivalence, statistical similarity, or qualitative analogy each establishes a different kind of sameness.

The specification of state space is another unresolved problem. Many formal models assume that relevant variables, entities, and action types are defined before the modeled dynamics begin. Sections 2.33 and 2.36 relaxed this assumption by allowing changing topology, participant composition, and generative rules. Yet a formal model still requires some representational domain in which such changes are expressible. Historical novelty can exceed a model’s vocabulary when new institutions, categories, technologies, or practices emerge. The resulting limitation is epistemic as much as mathematical: the analyst may not know in advance which dimensions will become relevant.

Measurement connects this problem to evidence. A formal variable becomes empirically meaningful through operationalization, data generation, classification, and interpretation. Social categories can change while the numerical variable retains the same label. Data-producing institutions can alter definitions and coverage. Strategic actors can respond to metrics. Computational systems can make classifications causally effective by embedding them in allocation procedures. A generative relational methodology therefore has to study the production of data and representations when those representations participate materially in the system being represented.

Formal pluralism also creates a problem of interoperability. Different models can illuminate different scales or mechanisms, yet connecting them requires mappings that may lose information. A network model may represent who is connected while omitting meanings of connection. A dynamical model may represent aggregate state variables while suppressing institutional heterogeneity. An agent-based model may represent heterogeneous behavior while relying on simplified rules. A field representation may capture distributed constraints while abstracting from discrete organizational boundaries. Multimodel analysis can improve explanation when these losses are explicit, but combining models mechanically can multiply incompatible assumptions.

The unresolved task for GR is consequently to build a disciplined relation between formal objects and empirical-relational claims. Formalization should state what is represented, which distinctions are preserved, which are suppressed, what empirical evidence supports the mapping, and how the representation may fail under historical transformation. This requirement leaves room for mathematical ambition while preserving ontological suspension. GRE will need such discipline particularly when

formal results are used to guide intervention, because errors in representation can become consequential when they are translated into policy, organizational design, or automated allocation.

### **2.37.5 Unresolved Integration of Relation, Value, and Generativity**

The four convergences above reveal a common architecture without yielding a completed synthesis. Relation concerns constitution, dependence, and structured connection. Generation concerns the production of later conditions. Value concerns appraisal, worth, opportunity, and normative evaluation. Formal representation concerns the disciplined construction of models through which these phenomena can be described, compared, and sometimes predicted. GR brings these registers into one research programme, but several integration problems remain open and should remain visible as the theory develops.

The first concerns relational individuation. A generative account needs some way to identify participants and relations while also allowing those identities and relations to change. Excessively fixed individuation hides constitutive change; excessively fluid individuation makes comparison across time difficult. The relevant solution is likely domain-sensitive rather than universal. A legal entity may have a clear institutional boundary for one research problem while requiring relational reconstruction for another. The theory therefore needs explicit criteria for when identity is treated as stable, when it becomes a dependent variable, and how continuity is established across transformation.

The second concerns generative attribution. Historical systems contain many simultaneous processes, delayed effects, feedbacks, and cross-scale interactions. Showing that a later condition follows an earlier relation is insufficient to establish that the relation generated the condition. GR requires evidence concerning mechanisms, mediation, counterfactual relevance, process sequence, comparative variation, or other forms of warranted attribution appropriate to the domain. This problem connects the theory directly to the methodological chapters that follow later in the book. Generativity becomes analytically useful only when claims about generation can be made more discriminating than broad narratives of influence.

The third concerns normative orientation. Generativity is descriptively neutral enough to include the production of capability and the production of vulnerability, the reproduction of trust and the reproduction of domination, or the expansion and contraction of future possibility. Normative evaluation therefore enters through additional criteria. GRE must ask which capacities matter, whose possibilities are expanded, whose are constrained, how burdens and benefits are distributed, and which relations deserve preservation or transformation. Justice cannot be read directly from dynamical persistence or productive fecundity.

The fourth concerns value conversion and non-equivalence. Economic systems continuously convert among heterogeneous forms: labor into income, knowledge into intellectual property, trust into reduced transaction cost, land into collateral, attention into advertising revenue, ecological capacity into production, and symbolic distinction into economic advantage. These conversions can be institutionally real without implying that the underlying values are equivalent. GRE therefore needs



to study conversion mechanisms, exchange ratios, institutional permissions, losses, residuals, and asymmetries while preserving the possibility of incommensurability. The difference between conversion and equivalence will become important in later analyses of circulation, return, and justice.

The fifth concerns scale and historical time. A relation can be beneficial at one scale and damaging at another; a process can be productive in the short run and capacity-destroying over a longer horizon. Microlevel adaptation can generate macrolevel lock-in, while macro institutions can reshape micro capacities. GR's multiscale orientation provides a language for these interactions, but it does not predetermine which scale should govern evaluation. Empirical analysis must identify the relevant temporal and relational ranges, and normative analysis must justify how conflicts across scales and generations are handled.

The sixth concerns reflexivity. Social participants can interpret theories, respond to classifications, alter their behavior under measurement, contest rules, and deliberately redesign institutions. Researchers and computational systems can also enter the generative process through forecasts, rankings, standards, and automated decisions. This reflexivity complicates the separation between model and target without eliminating it. GR therefore needs a method for expanding the analytical boundary when representations become causally active, while retaining a practical boundary for research. Chapter 5 will develop the epistemic implications of this problem more fully.

The seventh concerns formal openness. A theory capable of using networks, dynamical systems, fields, agent-based simulation, statistical models, historical narrative, and interpretive reconstruction gains flexibility at the cost of a simple common formal language. A premature universal formalism could suppress important domain differences, while unstructured pluralism could make theoretical claims difficult to compare. The present programme therefore favors a modular architecture: common conceptual questions concerning relation, generation, value, scale, representation, and historical transformation can be paired with formalisms chosen for specific mechanisms and evidential contexts. Stronger mathematical integration can be developed where mappings among models are explicit and justified.

An eighth problem concerns the transformation of evaluative and epistemic criteria themselves. Historical processes can alter what counts as economically valuable, scientifically credible, legally recognizable, aesthetically significant, or politically legitimate. This possibility creates a second-order challenge. A generative analysis may need to study the formation of the criteria by which its objects are later evaluated while still retaining enough normative and epistemic distance to assess those criteria critically. Historical situatedness therefore cannot become simple relativism. Revisability requires standards of argument, evidence, and justification even when those standards possess histories.

These unresolved problems clarify the status of GR at this stage. It is best understood as a structured research architecture that coordinates questions across relational, temporal, normative, and representational registers. Its coherence comes from recurrent problem forms and explicit distinctions rather than from reduction to one ontology, one value theory, or one mathematical language. Such an architecture can still generate strong claims locally, provided that each claim states the

relevant entities, relations, time horizon, scale, value criterion, evidence, and model assumptions.

The implications for GRE are now sufficiently clear to complete the chapter. GRE does not emerge because the preceding traditions secretly converge on one final theory. It emerges because contemporary economic problems repeatedly require concepts that existing traditions have developed in partial and complementary ways: historically constituted relations, changing productive and institutional conditions, plural forms of value, normative evaluation, multiscale dynamics, and disciplined formal representation. The remaining task is to state how GRE inherits these resources selectively and what kind of economic research programme follows from that inheritance. The final section therefore closes the chapter by locating GRE within the historical-material, philosophical-relational, economic-normative, and scientific-formal lineages reconstructed here.

## 2.38 The Theoretical Position of Generative Relational Economics

The preceding genealogy has reconstructed the intellectual resources through which Generative Relational Economics (GRE) becomes conceptually available. The role of this final section is to state GRE's theoretical position within that landscape without converting a heterogeneous genealogy into a claim of theoretical unification. Its objective is to identify what GRE inherits, what it modifies, and what it leaves to neighboring traditions and later chapters. The discussion proceeds through four inheritances—historical-material, philosophical-relational, economic-normative, and scientific-formal—before characterizing GRE as an integrative economic research programme. The method is positional and synthetic. Inheritance denotes a selective use of concepts, problem forms, and methods whose original differences remain visible; it does not imply that the reviewed traditions anticipated GRE or that GRE supersedes them.

GRE occupies a specific level of analysis. Generative Relational Theory (GR) supplies a broader meta-framework for studying historically consequential relations, recursive generation, changing conditions of possibility, and transformation of generative rules. GRE develops that orientation within economic inquiry. Its principal objects include production, allocation, circulation, reproduction, valuation, ownership, labor, care, credit, institutional capacity, technological infrastructure, ecological dependence, power, and the distribution of future economic possibilities. GRE therefore remains answerable to economic evidence and economic problems even when its conceptual resources originate in philosophy, sociology, political economy, systems science, or other domains.

The theoretical position is consequently plural but bounded. GRE accepts that a conventional allocation model can be the most adequate representation for one problem, that institutional economics may explain another more directly, that Marxian political economy may provide the strongest account of historically specific relations of production, and that capability, feminist, commons, ecological, or justice traditions may illuminate dimensions that an explicitly generative-relational model does not capture well. GRE's contribution lies less in replacing these approaches than in organizing a class of questions that repeatedly crosses their boundaries: how economic relations become constituted; how they generate later capacities and constraints; how heterogeneous forms of value move through conversion and circulation; how productive, institutional, epistemic, ecological, and normative conditions interact across scales; and how the rules governing those processes can themselves change.

This position also limits the claims made at the end of Chapter 2. GRE has acquired an intellectual genealogy and a preliminary theoretical location; it has not yet received its full disciplinary constitution. Chapter 3 will specify the programme's objects, boundaries, research questions, explanatory ambitions, and relation to economics more directly. Chapters 4 and 5 will develop the ontological and epistemological commitments that remain provisional here. The present section therefore closes the foundational genealogy by identifying the inherited commitments that make those later constructions possible.

### 2.38.1 Historical-Material Inheritance

GRE inherits from historical-material and political-economic traditions a commitment to treating economic categories as historically constituted. Production, labor, capital, property, money, markets, firms, households, and states can acquire relatively stable institutional forms without thereby becoming timeless units of analysis. Classical political economy already connected wealth, production, distribution, accumulation, and social order; Marxian traditions made historically specific relations of production, class, accumulation, circulation, and reproduction central analytical objects; institutional and historical approaches further showed how rules, organizations, technologies, conventions, and path-dependent processes structure economic possibility (Smith 1776; Marx 1867; Polanyi 1944; North 1990). GRE takes this historicity as a starting discipline.

The inheritance has two consequences. First, GRE treats economic entities and variables as potentially dependent on the institutional and relational environments in which they operate. A firm is a legally and organizationally constituted actor whose boundaries can change through ownership structures, contracting practices, regulation, platform architectures, and technological integration. Labor is performed through historically specific arrangements of employment, care, coercion, autonomy, skill, and recognition. Property denotes institutionally organized bundles of rights and powers whose practical content varies across legal and political orders. Money, credit, and financial claims depend on systems of authorization, accounting, enforceability, expectation, and trust. The empirical usefulness of stable categories remains compatible with an inquiry into their historical production.

Second, GRE gives temporal priority to the reproduction and transformation of conditions. Historical-material analysis directs attention beyond isolated transactions toward the arrangements that make transactions recurrently possible: productive capacities, infrastructures, labor-power, institutional authority, ecological resources, technical standards, organizational routines, and social reproduction. Marxian theories of circulation and reproduction, feminist theories of social reproduction, and institutional approaches differ substantially in their explanatory commitments, yet each demonstrates that an economy persists through processes that renew or reorganize enabling conditions rather than through isolated acts alone (Fraser 2014; North 1990). GRE generalizes this question cautiously by asking which relations reproduce, expand, degrade, or transform the capacities from which later economic activity proceeds.

Historical dependence also enters GRE through sequencing and path formation. Institutional choices can modify later feasible alternatives; accumulated infrastructures can create complementarities and switching costs; classifications and legal forms can stabilize expectations; technological systems can reorganize the distribution of skills and bargaining positions. Path-dependence research provides concepts for increasing returns, lock-in, and temporally structured choice without implying that historical outcomes are predetermined (Pierson 2000). GRE adds a generative emphasis by examining how a path can alter the actors, relations, and evaluative criteria through which later choices are made.

This temporal orientation makes historical time analytically heterogeneous. Eco-

conomic processes unfold through multiple durations: a payment may settle in seconds, organizational routines persist for years, infrastructures endure for decades, demographic or ecological effects can span generations, and institutional categories can accumulate meanings over centuries. A relation that expands production in one interval may erode ecological or social capacities over another. GRE therefore treats time horizon as part of the specification of an economic claim. Generativity cannot be evaluated from an arbitrarily short temporal slice when the process under study redistributes future capacities or burdens.

The historical-material inheritance also restrains universalization. GRE does not presume that one observed economic configuration represents a natural endpoint or universal equilibrium form. Markets, firms, welfare institutions, intellectual-property regimes, household structures, development paths, and technological infrastructures are historically variable arrangements whose comparative analysis can reveal multiple viable or contested forms. This openness is compatible with identifying recurrent mechanisms. A mechanism such as cumulative advantage, institutional exclusion, network externality, or debt compounding can recur across contexts while taking different institutional forms.

GRE's distinctive extension concerns the historical production of generative conditions. A relation matters economically not only because it transfers an existing resource or changes a current payoff, but also because it can modify what participants will later be able to do, become, recognize, produce, exchange, or contest. Education can change future capability; infrastructure can open or close productive possibilities; debt can finance capacity while also restructuring future claims; platform rules can generate markets while reorganizing dependence; ecological extraction can create present output while narrowing later material possibility. These are heterogeneous mechanisms, and GRE does not reduce them to one causal form. The shared analytical question concerns their consequences for subsequent economic possibility.

Historical-material inheritance therefore gives GRE its temporal and institutional seriousness. Economic relations occur within histories, reproduce conditions, and can transform the categories through which later economic activity becomes intelligible. GRE preserves that insight while broadening the object from material production alone to heterogeneous generative conditions that include institutional, epistemic, technological, ecological, symbolic, and normative capacities where they have economic consequence.

### **2.38.2 Philosophical and Relational Inheritance**

GRE's philosophical inheritance supplies conceptual discipline for speaking about entities, relations, processes, appearances, interpretation, and value without allowing one convenient representation to determine ontology silently. Philosophies of relation and process, phenomenology, hermeneutics, pragmatism, and social theories of relational constitution contribute different resources to this task. Cassirer's functional orientation, Whitehead's process metaphysics, and later relational sociology each challenge forms of explanation that treat properties as fully intelligible apart from structured dependence, although they do so from different philosophical posi-

tions (Cassirer 1923; Whitehead 1929; Emirbayer 1997). GRE inherits the problem of relational constitution rather than a single metaphysical answer.

The first consequence is ontological restraint. Section 2.36 introduced ontological suspension as a GR discipline: an inquiry can study the relational constitution, persistence, and effects of an economic object without settling every question about its ultimate metaphysical status. GRE requires this restraint because its objects cross several ontological registers. A corporation is simultaneously a legal person, an organization, a contractual structure, an accounting entity, a productive arrangement, and a participant in networks of power and exchange. Money can be represented through legal claims, accounting positions, media of payment, or institutional relations. An algorithm can be a technical artifact, organizational procedure, decision rule, property asset, or participant in a mediated economic relation. The relevant representation depends on the question under investigation.

Ontological suspension does not make representation arbitrary. GRE asks whether a representation preserves the distinctions required for the explanatory or evaluative task. An analysis of firm productivity may legitimately treat the firm as a bounded unit; an analysis of subcontracting, ownership, or platform dependence may require the firm's boundary itself to become an object of inquiry. A household can be an observational unit in one statistical model while requiring internal relational analysis when care, bargaining, gendered labor, or intrahousehold distribution becomes relevant. Relational analysis therefore changes resolution according to the mechanism under study.

The second inheritance concerns constitution through relation. Some economically significant properties are relational by their structure. Debt positions require creditor-debtor relations; ownership requires recognized institutional relations concerning control and exclusion; bargaining power depends on alternatives, dependencies, and enforceable rights; reputation depends on histories of recognition and communication; market access depends on institutional and infrastructural connections. Other properties, including biological or technical capacities, can remain meaningful outside a specific social relation while still being economically effective only within relational configurations. GRE consequently avoids converting relational dependence into a universal claim that every property is wholly relational.

The third inheritance concerns interpretation and symbolic mediation. Economic actors respond to prices, classifications, expectations, narratives, rankings, contracts, forecasts, and institutional meanings. Hermeneutic and linguistic traditions show that interpretation occurs through historically available languages and practices rather than through direct access to self-interpreting facts. GRE incorporates this insight when representations themselves enter economic processes. A credit score, risk category, performance metric, accounting standard, or policy model can begin as a representation and later influence the relations it describes. The representational layer can therefore become generative when participants orient conduct toward it.

This reflexive possibility connects philosophy of interpretation with social ontology. Categories can organize recognition and action; repeated classification can stabilize an institutional reality; contested interpretation can transform what a category permits or excludes. GRE will later examine such processes empirically rather than treating symbolic mediation as sufficient explanation. The relevant question is how



meanings are stabilized, by whom, through which institutions, with what material consequences, and under what conditions they change.

The fourth inheritance concerns process and emergence. Process traditions prevent GRE from treating a stable economic configuration as explanatory merely because it persists. Persistence itself can require recurrent work, resources, recognition, enforcement, maintenance, or feedback. Emergence likewise directs attention to properties that arise at a level of organization without being simply attributable to one component. The language remains demanding: a claim of emergence should identify the level, mechanism, and explanatory remainder involved rather than functioning as a synonym for complexity or surprise.

The philosophical-relational inheritance therefore gives GRE a vocabulary for asking how economic objects are constituted, represented, interpreted, stabilized, and transformed. It also establishes boundaries. GRE does not require acceptance of a universal relation-first metaphysics; it does not reduce persons to social positions; and it does not treat interpretive construction as evidence that material constraints are merely discursive. The programme instead holds relational, material, institutional, symbolic, and experiential dimensions together where the economic problem requires them.

This plural ontology of inquiry is one reason GRE remains a domain-specific programme rather than a total social theory. Relations studied in economics intersect with law, politics, ecology, education, technology, family life, and culture. GRE can trace those interfaces when they affect economic generation, valuation, allocation, or reproduction, while leaving the fuller analysis of neighboring domains to the relevant disciplines and broader GR research programmes.

### **2.38.3 Economic and Normative Inheritance**

GRE remains an economic programme because it inherits central economic problems rather than substituting a general relational vocabulary for them. Scarcity, choice, allocation, production, exchange, distribution, incentives, information, coordination, welfare, growth, accumulation, and institutional design remain legitimate and often indispensable objects of analysis. Marginalist and neoclassical traditions provide precise tools for understanding trade-offs, equilibrium, efficiency, and decentralized allocation; mechanism and information approaches sharpen questions of incentives and knowledge; institutional and political-economic traditions place those mechanisms within systems of rules, ownership, authority, and historical power (Arrow and Debreu 1954; Debreu 1959; North 1990). GRE incorporates these achievements selectively rather than defining itself through opposition to mainstream economics.

The generative-relational extension begins when the objects ordinarily treated as inputs to an economic problem become consequences of earlier economic relations. Preferences can be shaped through education, advertising, habit, and institutional context. Feasible sets can change through infrastructure, law, technology, health, ecological degradation, or accumulated wealth. Agents can acquire or lose capabilities through relations of work, care, exclusion, training, credit, and political recognition. Markets themselves require institutional and informational conditions. A final allocation can therefore affect the conditions under which later allocations occur. GRE

makes such recursive effects explicit where they are empirically consequential.

Capability approaches provide one major bridge between present distribution and future possibility. Sen's distinction among resources, functionings, capabilities, and conversion factors prevents evaluation from identifying possession automatically with effective freedom (Sen 1985; Sen 1992; Sen 1999). GRE inherits this sensitivity to conversion conditions and extends it toward the generation of capabilities over time. An educational resource, for example, matters through the capabilities it helps develop under specific social and institutional conditions. A loss of health, mobility, legal status, or access can reduce the value realizable from nominally equal resources. Generative analysis asks how those conversion conditions themselves are produced and distributed.

Care and social-reproduction traditions deepen the same problem from another direction. Economic production depends on forms of maintenance, caregiving, household labor, emotional support, education, and social reproduction that can remain weakly represented in market measures while being indispensable to later productive and social capacity (Fraser 2014; Tronto 1993). GRE therefore treats maintenance and reproduction as possible generative processes rather than relegating them conceptually beneath visible production. This does not imply that every act of care should be monetized or reduced to economic output. It means that economic analysis must be able to represent dependence on capacities generated outside conventional market exchange.

Commons and cooperative traditions contribute another set of institutional possibilities. Ostrom's work demonstrates that collective-resource governance cannot be adequately represented by a simple dichotomy between privatization and centralized state control; durable institutional arrangements can arise through diverse combinations of rules, monitoring, participation, graduated sanctions, nested organization, and local knowledge (Ostrom 1990; Ostrom 2005). GRE inherits the comparative institutional lesson and adds questions concerning what governance arrangements generate over time: trust, monitoring capacity, exclusion, knowledge, ecological resilience, organizational competence, or dependence.

Value theory introduces a further layer. Section 2.14 distinguished value, valuation, and price, while Sections 2.28 and 2.29 reconstructed relational value, relational goods, and generative justice. GRE treats market price as one consequential form of valuation and coordination without assuming that it exhausts the values relevant to economic life. Productive, ecological, cultural, epistemic, relational, and capability values can enter economic processes through different institutions and conversion mechanisms. Their coexistence raises problems of comparability and commensurability that cannot always be resolved through a common metric.

This is where Eglash's generative-justice tradition becomes particularly important. Generative justice directs attention to value-producing processes in which participants retain or recover control over generative conditions and in which value can circulate back toward the communities and capacities from which it emerged (Eglash 2016; Eglash, Robinson, et al. 2024). GRE inherits this concern while extending the research space toward heterogeneous forms of value, conversion interfaces, capture, dissipation, regeneration, and generative foreclosure. Such extensions should remain explicitly distinguished from the established generative-justice literature rather

than being attributed retrospectively to it.

Normative evaluation therefore enters GRE at more than one point. Distribution asks who receives resources, income, risk, or opportunity. Procedure asks how decisions are made and contested. Relational justice asks how institutions structure status, domination, recognition, and standing. Generative justice asks who participates in and controls the processes through which future value and capability are produced. These dimensions can support one another and can also conflict. A highly productive arrangement may generate severe dependence; an equal present allocation may leave unequal capacity to convert resources into future opportunity; a procedurally inclusive institution may reproduce ecological costs across generations.

GRE accordingly separates descriptive generativity from normative desirability. A process can be powerfully generative while producing domination, vulnerability, exclusion, ecological destruction, or epistemic concentration. The fact that a relation reproduces itself does not justify its continuation. The fact that a system expands aggregate productive capacity does not settle the distribution or justice of that capacity. Normative claims require explicit criteria and arguments rather than being inferred from persistence, growth, complexity, or generativity itself.

Power enters this architecture through control over relations and conversion conditions. Economic actors differ in their capacity to set terms of exchange, define classifications, control infrastructures, determine access, appropriate returns, impose externalities, or shape the future rules under which others act. GRE will later analyze these mechanisms in greater detail. At the foundational level, the important point is that power can operate through the generation of future constraints and capacities as well as through immediate command or unequal possession.

The economic-normative inheritance thus locates GRE within economics while widening the temporal object of evaluation. Economic analysis concerns present allocation and exchange, and it can also concern the production of future capabilities, dependencies, institutions, values, and ecological conditions. GRE's distinctive object is the relation between these present economic processes and the conditions they generate for later economic and social possibility.

#### **2.38.4 Scientific and Formal Inheritance**

GRE's scientific and formal inheritance provides languages for representing change without dictating one universal mathematical form. Systems theory and cybernetics contribute feedback, regulation, recursive organization, and adaptive response. Dynamical-systems theory contributes state spaces, trajectories, stability, attractors, bifurcations, and time-dependent dynamics. Complexity science contributes emergence, heterogeneity, multiscale organization, adaptation, and coevolution. Network, hypergraph, and multilayer approaches contribute relational topology and higher-order interaction. Field and gauge formalisms contribute distributed conditions, locality, representational equivalence, and sensitivity to backgrounds. Information theory, computation, and simulation contribute precise questions concerning representation, uncertainty, computability, complexity, and model-mediated experimentation (Strogatz 2024; Kivelä et al. 2014; Shannon 1948; Turing 1937; Winsberg 2010).

GRE inherits these resources through methodological pluralism. A dynamical

model is useful when the relevant state variables and evolution rules can be specified with sufficient stability. A network model is useful when topology and interaction structure are central. An agent-based simulation can represent heterogeneous local rules and emergent aggregate behavior. A statistical model can estimate associations, distributions, or causal effects under explicit assumptions. Historical reconstruction can recover institutional sequences and transformations that a fixed-variable model obscures. Interpretive methods can examine classifications, meanings, and normative reasoning. The method follows the problem rather than the programme prescribing one privileged representation.

This pluralism is compatible with formal rigor. Each formalization should identify its state variables or objects, relations, parameters, temporal scale, boundary conditions, empirical mapping, and domain of validity. A model can be highly informative while idealized. The requirement is to make the idealization visible and to distinguish what follows mathematically from what is supported empirically. Section 2.35 emphasized the same distinction for computation and simulation: an output is evidence about the behavior of a specified model, while its relevance to an economic target depends on the warranted relation between model and target.

Dynamical concepts have particular importance for generative analysis. Attractors can represent recurrent organization, but attraction is neither a goal nor a normative good. Bifurcations can model qualitative changes in regimes, but an abrupt historical event does not establish a mathematical bifurcation without a justified mapping. Criticality can describe specific formal phenomena and should not become a generic term for social instability. GRE uses these concepts where they clarify mechanisms and retains ordinary historical or institutional language where formalization would add little.

Network and higher-order models contribute an analogous discipline. Economic relations rarely form one homogeneous graph. Ownership, credit, employment, information, supply, kinship, care, legal authority, and technological dependence can occupy different layers and interact across them. Hypergraphs or higher-order structures can represent processes involving more than pairwise ties. Adaptive-network models can allow the network itself to change with node states. Yet even these rich formalisms usually require prior specification of node identities, relation types, and admissible transformations. GRE's generative question begins where those categories themselves acquire histories.

Field language supplies another representational option for distributed conditions. Prices, legal constraints, infrastructure, norms, ecological exposure, information access, or institutional authority can sometimes be represented as spatially or relationally distributed conditions affecting local possibilities. The analogy must remain explicit. A useful social field representation does not establish that an economy is ontologically a physical field, and gauge-theoretic language does not transfer simply because two representations contain formal symmetry. Section 2.34 therefore treated these formalisms as resources for disciplined comparison under ontological suspension.

Information and computation sharpen the distinction between data and meaning. Shannon information quantifies uncertainty relative to a probability structure; it does not by itself measure semantic significance or knowledge (Shannon 1948). Com-

putability and complexity place limits on classes of formal procedure, while social inquiry also encounters identification problems, incomplete observation, strategic behavior, historical novelty, interpretive disagreement, and normative uncertainty. GRE therefore avoids treating computational tractability as equivalent to epistemic adequacy.

The scientific inheritance becomes most distinctive when combined with historical transformation. A fixed formal model can represent states changing under stable rules. Nonautonomous and adaptive models can represent changing environments, parameters, or topologies. GR and GRE ask a further question when economic history transforms the categories, relations, or evaluative structures from which the model itself was constructed. Such transformation does not render formalization impossible. It requires explicit attention to model revision, regime-dependent variables, changing boundaries, and the possibility that a representation adequate to one historical interval loses adequacy in another.

Formal openness is therefore part of GRE's theoretical position. The programme seeks formal development where formalization performs analytical work, while leaving room for historical, interpretive, qualitative, and institutional inquiry that accesses different aspects of economic reality. A future GRE may develop stronger mappings among dynamical, network, field, and categorical representations. At the present stage, methodological discipline is more valuable than premature mathematical unification.

### **2.38.5 Generative Relational Economics as an Integrative Research Program**

The four inheritances locate GRE as an integrative research programme within economics. Integration here has a specific meaning. GRE coordinates questions that existing traditions often distribute across separate analytical registers: historical constitution, relational dependence, generation of future conditions, heterogeneous value, normative evaluation, multiscale dynamics, formal representation, and transformation of the rules through which later economic states become possible. The programme gains coherence from the relation among these questions rather than from a claim that they reduce to one explanatory principle.

The central analytical object can now be stated more precisely. GRE studies economic processes in which relations among heterogeneous participants and conditions contribute to the generation, reproduction, transformation, distribution, or foreclosure of later economic capacities and possibilities. Those participants can include persons, households, firms, states, communities, organizations, technical systems, ecological systems, legal institutions, and other domain-relevant entities. The relevant relations can include exchange, production, ownership, labor, care, credit, authority, cooperation, competition, recognition, information, infrastructural dependence, and ecological coupling. The analytical task is to specify which relations matter for a particular problem rather than to presume that every relation belongs in one model.

This object distinguishes generativity from immediate output. A productive process can generate commodities while degrading the skills, trust, ecological conditions,

or institutional capacities required for future production. A transfer can increase present consumption while altering future dependence. A platform can generate new opportunities while centralizing access to data or market participation. A co-operative can distribute current surplus while also generating organizational competence and collective governance capacity. GRE asks about these temporally extended consequences while preserving conventional measures of output, income, cost, and efficiency where they remain relevant.

A second defining feature is heterogeneity of value. Economic processes can transform material resources, labor, knowledge, attention, ecological capacity, legal rights, symbolic recognition, and social relations through interfaces that permit some forms of conversion while blocking others. GRE treats the institutional architecture of conversion as an economic object. Who can convert which resource into which capability, under what conditions, at what loss, with what return, and with which external consequences can matter as much as the nominal quantity initially possessed. Conversion does not imply equivalence, and a common price does not dissolve differences among the values converted.

A third feature is recursive economic constitution. Economic relations can alter the actors and conditions that later participate in economic relations. Education changes capability; employment can develop or erode skill; organizational routines create competence; debt changes future claims; property regimes shape incentives and access; technological standards reorganize coordination; ecological extraction changes later resource conditions; institutions modify expectations and enforcement. GRE treats such recursion as a family of mechanisms requiring empirical differentiation. The concept of a generative relational system from Section 2.36 provides an abstract language for this recursion, while later chapters will develop economic-specific forms.

A fourth feature is multiscale analysis. Economic generation can move across individual, organizational, sectoral, institutional, ecological, national, and transnational scales. Local adaptation can create aggregate lock-in; national policies can reorganize household possibilities; global supply chains can transmit shocks and dependencies; organizational design can transform individual learning; ecological degradation can feed back into prices, health, migration, and fiscal capacity. GRE consequently treats scale as an analytical choice requiring justification rather than as a fixed hierarchy. Cross-scale effects are especially important where benefits and burdens appear at different levels.

A fifth feature is explicit normative separability. GRE can describe the generative structure of a process without endorsing it. Normative assessment enters through articulated criteria concerning welfare, capability, justice, freedom, sustainability, recognition, democratic participation, or other justified values. The programme should therefore support both positive and normative research while marking the transition between them. This separation also permits disagreement: two researchers may accept the same generative account while defending different normative evaluations, or share a normative commitment while disagreeing about the mechanism that would realize it.

A sixth feature is reflexive openness. Economic representations can become components of the systems they describe. Forecasts alter expectations; classifications al-



ter eligibility; metrics reshape organizational conduct; models inform policy; algorithms allocate opportunities; theories influence institutional design. GRE therefore treats model use as potentially generative when representations enter causal or institutional relations. This does not eliminate the distinction between model and target. It creates a research problem concerning when and how the representational layer becomes part of the target's subsequent history.

These features suggest a recognizable GRE research sequence without imposing a universal method. A study can begin by identifying an economic object and historical boundary; specifying relevant entities, relations, and representations; tracing how current configurations were produced; examining the mechanisms through which they generate or reproduce later capacities and constraints; identifying forms of value and their conversion interfaces; analyzing distribution, power, scale, and time horizon; evaluating the adequacy of available evidence and models; and, where normative questions arise, stating the criteria through which alternatives are assessed. Different studies can enter this sequence at different points and use different methods.

The programme's boundaries are equally important. GRE does not claim jurisdiction over every relational phenomenon. A purely legal question belongs primarily to legal analysis even when its consequences later affect economic relations. A theory of consciousness, aesthetic experience, or religious practice remains outside GRE unless an economic problem specifically requires an interface with those domains. Broader GR research can coordinate such cross-domain questions without making economics the organizing discipline. This boundary protects GRE from becoming a vocabulary that expands by relabeling neighboring scholarship.

GRE also remains corrigible by established economics. If a standard price-theoretic model explains an observed allocation with greater precision and fewer unsupported assumptions, GRE has no reason to replace it. If a causal inference design identifies a policy effect adequately, generative-relational vocabulary should not be added decoratively. GRE becomes useful where the research problem requires historically changing relations, recursive capacity formation, heterogeneous value conversion, multiscale reproduction, reflexive representation, or transformation of economic conditions that narrower models legitimately hold fixed. Its contribution should be judged by explanatory, empirical, methodological, and normative gains in those domains.

The position established in Chapter 2 can therefore be summarized as disciplined integration under retained plurality. Historical-material traditions provide the temporality and institutional specificity of economic categories. Philosophical and relational traditions provide conceptual resources for constitution, interpretation, process, and ontological restraint. Economic and normative traditions provide rigorous problems of allocation, production, welfare, capability, reproduction, value, justice, and institutional design. Scientific and formal traditions provide representational resources for dynamics, networks, fields, information, computation, and multiscale organization. GR supplies the immediate architecture through which relation and generation can be studied together. GRE develops that architecture as an economic research programme whose distinctive questions concern the production and distribution of future economic possibility.

The chapter therefore ends with a position rather than a completed system. GRE has an intellectual genealogy, a set of inherited distinctions, and a preliminary object of inquiry. Its concepts remain subject to specification, empirical testing, normative argument, and revision. Chapter 3 turns from genealogy to disciplinary constitution. It will state more directly what GRE studies, which questions define its research programme, how it relates to established economics and neighboring disciplines, and what standards should govern its future development. The foundations assembled in the present chapter provide the conceptual resources for that task while preserving the theoretical plurality from which the programme emerged.

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