

Heterogeneous Value Conversion and Justice: A Generative Relational Discussion

Wanhong HUANG
huangwanhong@serendip.ngo

Abstract

Heterogeneous value conversion occurs when values embedded in different practical, institutional, symbolic, ecological, or economic relations are rendered comparable, exchangeable, compensable, or otherwise transformable across value forms. Such conversion is often represented through a ratio, price, transfer, or settlement rule, yet the justice of conversion can depend on processes that precede and follow the visible exchange: entity identification, recognition, attribution, commensuration, procedural ordering, risk allocation, institutional stabilization, power over conversion interfaces, and the later relational consequences of the conversion itself. This discussion paper reconsiders these problems through the Generative Relational framework while drawing on established work in economics, political economy, philosophy of money, procedural and epistemic justice, capability approaches, exploitation theory, relational equality, and value pluralism.

The paper adopts an integrative objective and treats substantive criteria of just conversion as theory-relative. It uses a common relational language to distinguish several sites at which normative questions arise: what counts as the entity being valued; which historical and relational features become legible; how heterogeneous values are made commensurable; who can shape conversion rules and interfaces; how benefits, burdens, risks, and exit possibilities are distributed; how conversion nomos emerges and becomes revisable; and how different theories of justice evaluate the same conversion history through different informational and normative commitments. Monetary conversion and currency hierarchy provide an important case, while labor, environmental compensation, knowledge, and retrospective recognition illustrate the wider scope of the problem.

The resulting argument treats conversion justice as broader than the fairness of a numerical ratio. Conversion may be normatively consequential through its epistemic architecture, procedural structure, institutional embedding, distributional incidence, relational dependencies, and effects on future possibilities. The paper therefore offers a structured discussion of heterogeneous conversion rather than a single substantive metric, and it preserves disagreement among normative traditions where their evaluative commitments remain irreducible.

Keywords: heterogeneous value; conversion justice; commensuration; normogenesis; epistemic justice

Discussion Paper Note

This manuscript reconsiders heterogeneous value conversion and justice through a Generative Relational integrative language. Its primary contribution is synthetic and analytical. The component insights discussed in the paper have substantial antecedents in economics, political economy, philosophy of money, social ontology, procedural justice, epistemic justice, capability theory, exploitation theory, relational equality, and value pluralism. GR supplies the integrative vocabulary used here, while those component insights retain their disciplinary provenance.

The companion paper, *A Preliminary Formalism for Heterogeneous Value Conversion in the Generative Relational Framework*, provides background vocabulary for conversion histories, entity identification, order-sensitive procedures, nomos, and theory-relative evaluation. The present paper uses that vocabulary selectively and reproduces the concepts needed for the substantive discussion locally, so the argument remains accessible at the level of this discussion paper.

The manuscript maintains ontological suspension. Relational, processual, historical, and dynamical descriptions function as analytical representations, while final metaphysical questions concerning value, money, agency, and social reality remain open. Normative disagreements are preserved where different theories rely on irreducible informational bases or substantive commitments.

Responsible Use and Rights Reservation

The author encourages good-faith discussion, criticism, independent inquiry, and responsible use of the material in this work. Separately from the licence's terms, the author asks users to consider foreseeable harms when adapting or applying the arguments developed here. This ethical request leaves the licence's permissions and legally authorized uses unchanged.

The author retains the rights preserved under CC BY-NC 4.0 and may pursue remedies to which the author is legally entitled for breach of the licence or violation of independently applicable rights. Reuse remains independent from authorial endorsement. Third-party rights require authorization from their respective holders where applicable. Copyright exceptions and limitations remain fully available.

Notices

Status. This working draft is a discussion paper on heterogeneous value conversion and justice. It synthesizes established economic, political-economic, philosophical, and normative perspectives within a Generative Relational vocabulary. Its contribution lies in integration and reframing; the relational emergence of money, nonlinear economic dynamics, and the justice theories discussed here retain their established disciplinary provenance. Substantive criteria of just conversion remain theory-relative and open to further argument.

Licence. Except where otherwise indicated, copyright 2026 Wanhong Huang. This work is made available under the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0). Subject to its terms, the licence permits sharing and adaptation for noncommercial purposes with appropriate attribution, a link to the licence, and an indication of changes.

Statement on the use of language models. The exploratory discussions and preparation of this paper involved OpenAI's ChatGPT. ChatGPT supported exploratory dialogue, formal reconstruction, argumentative criticism, source discovery followed by verification, and drafting in $\text{\LaTeX}$. The author selected the research questions, directed and approved the theoretical commitments and epistemic status of the claims, and bears sole responsibility for the manuscript, including its arguments, conclusions, and errors. Authorship credit remains with the human author.

Contents

1	Introduction	5
2	Heterogeneous Value and the Conversion Problem	7
3	Relational Constitution of Conversion	10
4	Epistemic Conditions of Conversion	14
5	Common Equivalence and Monetary Conversion	18
6	Conversion Nomos	23
7	Procedural Dimensions of Conversion Justice	27
8	Distributive and Relational Consequences	30
9	Normative Perspectives on Conversion	34
10	Generative Relational Integration of Conversion Justice	38
11	Emergent Normativity	43
12	Governance of Conversion Interfaces	47
13	Illustrative Conversion Cases	51
14	Structural Limits of Heterogeneous Conversion	55
15	Integrative Implications and Research Agenda	58
16	Conclusion	63
A	Notation Reference	66

1 Introduction

This section establishes the role, scope, and argumentative structure of the paper. The discussion introduces heterogeneous value conversion as a normative problem that extends beyond the determination of a conversion ratio, identifies the different sites at which justice questions can arise, and states the paper's integrative use of the Generative Relational framework. The method is conceptual and comparative: established economic and philosophical perspectives are treated as resources for examining a shared conversion problem while their disagreements remain visible.

A large range of social practices depends on the conversion of values that are heterogeneous in origin, representation, or institutional meaning. Labor is compensated through wages; currencies are exchanged across monetary systems; ecological damage is translated into compensation, restoration obligations, or regulatory quantities; knowledge becomes credit, authorship, intellectual-property claims, reputation, or income; legal systems convert injury into remedies; and public institutions translate historically accumulated claims into categories of eligibility, recognition, and entitlement. In each case, a visible conversion may be expressed compactly as an amount, ratio, settlement, transfer, or equivalence relation. The normative significance of the process can nevertheless depend on structures that are absent from the compact representation.

The first difficulty concerns the entities entering conversion. The symbols attached to a transaction can give the impression that the relevant values and value holders are already constituted before the conversion begins. In practice, the entity treated as a unit of valuation may depend on prior classification, recognition, attribution, historical reconstruction, evidentiary access, and institutional boundaries. A day of labor can be represented as hours, output, contractual service, skilled contribution, foregone opportunity, or participation in a wider productive relation. Environmental loss can be represented through market price, replacement cost, ecological function, cultural meaning, or legal injury. Currency can be represented as a unit of account, a payment instrument, a store of purchasing power, a claim embedded in a monetary system, or an internationally convertible asset. These representations overlap without being interchangeable.

A second difficulty concerns commensuration. Conversion requires enough common structure for a relation to be established between heterogeneous values, yet practical comparability does not establish complete equivalence. Monetary pricing, legal compensation, administrative scoring, bargaining, and accounting can make unlike objects operationally comparable for a particular purpose. The resulting common scale may preserve some dimensions of the values while compressing or excluding others. The justice problem therefore includes the conditions under which commensuration is produced, the informational losses it introduces, and the authority through which one representation becomes institutionally effective.

A third difficulty concerns procedure. Conversion unfolds through sequences of recognition, classification, valuation, negotiation, authorization, transfer, settlement, and possible revision. The order of these operations can affect both the information available to participants and the relational situation in which later operations occur. Recognition of a contribution before contractual settlement can have different consequences from retrospective recognition after rights and benefits have already been allocated. Similar differences arise when environmental significance is identified before development, when currency risk becomes visible before contractual denomination, or when historical contribution is recognized only after an asset or institution has changed hands. Procedural justice therefore concerns more than equal treatment within a fixed conversion rule; it also concerns the construction and sequencing of the procedures through which the rule becomes applicable.

A fourth difficulty concerns power over conversion interfaces. Actors can differ in their ability to define categories, select evidence, set units of account, determine admissible methods of valuation, choose settlement media, absorb risk, hedge against conversion losses, or reopen a completed conversion. These asymmetries can be distinct from bargaining power over the final numerical ratio. An actor that controls the interface through which a value becomes legible can shape the space of possible conversions before explicit bargaining begins. An institution that controls revision can similarly shape the distribution

of error after the conversion has occurred. Conversion justice therefore has an institutional and political-economic dimension even where the immediate transaction appears voluntary.

A fifth difficulty concerns the consequences produced after conversion. A transaction can redistribute money while simultaneously changing dependency, bargaining position, exit capacity, institutional status, future options, or exposure to later shocks. Equal monetary transfers need not generate equal capabilities or comparable relational positions. Conversely, a conversion that appears unequal at one descriptive level may be justified under a theory that gives priority to entitlement, voluntary transfer, basic liberties, capability, need, non-domination, or another normative consideration. The relevant evaluative object is therefore not exhausted by the final allocation.

These difficulties become especially visible in monetary conversion. Money supplies a powerful common language for expressing heterogeneous goods, labor, claims, and obligations, while currencies themselves remain heterogeneous and require further conversion. International monetary systems consequently contain multiple layers of equivalence: goods are expressed in currencies, currencies are converted into one another, and some currencies acquire wider roles in invoicing, settlement, reserve holding, and financial intermediation. Exchange rates and purchasing power vary across time, place, institutional arrangements, and international relations. A monetary amount can therefore function effectively as a common equivalent without constituting a spacetime-independent measure of welfare, labor, capability, or justice.

The present paper approaches these problems through a Generative Relational perspective. The role of GR in this discussion is deliberately limited. Relational emergence, institutional construction of money, nonlinear economic dynamics, procedural justice, epistemic injustice, capability theory, exploitation, relational equality, and value pluralism all have substantial intellectual histories outside GR. The objective here is to place several of these insights within a shared process language so that their points of contact and disagreement can be examined without attributing established results to a new framework.

Within this language, conversion is treated as a historically situated relational process. Values, subjects, institutions, conversion rules, and evaluative judgments can be represented as arising within evolving relational structures rather than as timeless primitives. Entity identification and recognition become analytically prior to some forms of valuation; conversion nomos becomes an object with a history of stabilization and revision; and normative theories can be interpreted as selecting different features of a conversion history for evaluation. The framework therefore supports comparison across theories while avoiding the assumption that they can all be translated into one scalar metric.

This approach also preserves a distinction between normative emergence and normative justification. A conversion practice can become stable, repeated, legally recognized, or socially normal without thereby becoming just. At the same time, normative judgment is itself situated within history: theories, classifications, legal doctrines, and moral evaluations can influence subsequent institutions and behavior. The paper therefore treats normativity as historically effective while leaving substantive justification to the relevant normative arguments rather than deriving justice directly from social stabilization.

The paper does not offer a universal definition of conversion justice. Its more limited claim is that heterogeneous conversion contains several analytically distinguishable normative sites: entity identification, recognition, commensuration, attribution, procedural ordering, power over conversion interfaces, distribution of benefits and burdens, conversion risk, exit and revision, normogenesis, and subsequent relational consequences. Different theories of justice illuminate different subsets of these sites. Their evaluations can conflict because they employ different informational bases and substantive commitments.

The remainder of the paper develops this argument in stages. Section 2 clarifies heterogeneous value, partial commensurability, conversion, and spatiotemporal dependence. Sections 3–4 examine relational constitution and the epistemic conditions under which entities become identifiable for conversion. Sections 5–8 develop common equivalence, conversion nomos, procedural structure, and distributive and relational consequences. Sections 9–12 compare normative perspectives, specify the integrative role of GR, and examine emergent normativity and governance. Sections 13–15 apply and delimit the framework through illustrative cases, conversion limits, and open questions before Section 16 concludes the argument. Appendix A collects the main notation used across the discussion.

2 Heterogeneous Value and the Conversion Problem

This section specifies the analytical object of the paper before the discussion turns to relational constitution, epistemic conditions, monetary equivalence, and justice. Its objective is to distinguish heterogeneous value from mere numerical difference, to separate commensuration from conversion, to clarify the role of partial commensurability, and to identify the spatiotemporal dependence of conversion. The argument is conceptual rather than empirical. It introduces a vocabulary that can later accommodate economic, legal, institutional, ecological, and normative cases without assuming that they share one substantive theory of value.

2.1 Heterogeneous Forms of Value

Values are heterogeneous when the relevant differences among them cannot be exhausted by locating each value on one already accepted scale. Numerical difference presupposes a common dimension: two monetary amounts, two lengths, or two temperatures can be compared because a measurement convention has already specified the quantity in which the comparison is made. Heterogeneous value presents an earlier problem. The objects under consideration may arise through different practices, depend on different relations, become visible through different institutional languages, and matter for different reasons.

A day of labor, a monetary claim, an ecological function, a legal entitlement, a historical contribution, a reputation, and a cultural attachment can all become objects of practical decision. Their practical significance, however, may be constituted through different relational structures. Labor can carry contractual, productive, bodily, temporal, and social-reproductive dimensions. Money can function as a unit of account, settlement medium, asset, claim, and access condition for later transactions. Ecological structures can matter through material reproduction, habitat, risk regulation, cultural meaning, and future option value. A legal entitlement can alter what actions are institutionally available even where its market price is undefined. Treating these objects as heterogeneous therefore concerns the structure through which their value becomes identifiable, rather than simply the magnitude ultimately assigned to them.

Definition 2.1 (Heterogeneous value). Within the present discussion, values are *heterogeneous* when their practical or normative significance is constituted through partially distinct relational, institutional, symbolic, material, or historical structures such that comparison requires an additional operation of representation, commensuration, translation, or judgment.

Definition 2.1 is intentionally broad. It does not imply that heterogeneous values can never be compared. It identifies the additional work required before a comparison becomes operational. In some settings that work is highly stabilized: a market price, legal schedule, professional standard, scoring rule, or accounting convention may make the comparison appear immediate. Stabilization reduces visible friction while leaving the underlying representational choices analytically relevant.

Heterogeneity can also occur within a value category that appears homogeneous at first sight. Two hours of labor share a temporal unit while differing in risk, intensity, skill formation, reversibility, or the relations through which the work becomes possible. Two monetary amounts expressed in the same currency share a unit of account while differing in timing, liquidity, contractual restrictions, or the purchasing opportunities available to their holders. Two environmental harms can receive the same monetary compensation while differing in reversibility and historical meaning. The relevant heterogeneity therefore depends on the purpose and scale of evaluation.

Table 1 summarizes several dimensions that can make conversion analytically heterogeneous. The dimensions can overlap in one case and need not all be present.

The table also indicates why heterogeneous value is not reducible to subjective preference diversity. Different persons may disagree while still using one shared metric, and one person may simultaneously recognize several value dimensions that resist reduction to a single metric. The problem addressed in this paper concerns the architecture through which such values are rendered sufficiently comparable for action.

Table 1: Illustrative dimensions of heterogeneity relevant to value conversion.

Dimension	Analytical question	Illustrative manifestation
Ontological	What kind of entity or relation is being treated as valuable?	Labor service, legal claim, currency balance, ecosystem function, symbolic recognition
Institutional	Through which institution does the value become actionable?	Market, court, contract, public agency, professional community
Representational	Through which category or indicator does the value become legible?	Wage rate, damages schedule, score, price, credential, index
Temporal	Which histories and future consequences matter to the value?	Training history, accumulated contribution, delayed harm, long-term capability
Relational	Which dependencies, contributors, or affected parties enter the evaluation?	Household, firm, community, infrastructure, international monetary network
Normative	Which reasons make the value relevant to judgment?	Welfare, entitlement, need, capability, recognition, non-domination

2.2 Commensuration and Partial Commensurability

Commensuration supplies a common representational basis through which heterogeneous values can enter comparison. The basis can be numerical, categorical, ordinal, procedural, or institutional. Monetary pricing is one important case, yet many conversions use other devices: legal categories, administrative scores, professional standards, negotiated equivalences, restoration obligations, or rights that establish priorities without assigning a single cardinal value.

Definition 2.2 (Commensuration). *Commensuration* is the construction or use of a common representational structure that permits two or more values to be compared for a specified practical or institutional purpose.

The phrase “for a specified purpose” is important. Commensuration can be adequate for one decision while remaining incomplete for another. A salary scale can compare positions for payroll administration without exhausting the personal, social, or historical significance of the work. A compensation schedule can determine a legal remedy without establishing that the injured object and the monetary award are equivalent in every relevant respect. A currency quotation can support settlement across monetary systems without converting the entire institutional meaning of one currency into another.

This motivates a distinction between complete and partial commensurability. Complete commensurability would require a sufficiently rich common scale to order the values for the full evaluative purpose at issue. Partial commensurability permits comparison along selected dimensions while preserving residual dimensions that remain outside the common scale.

Definition 2.3 (Partial commensurability). Values are *partially commensurable* relative to a purpose when a common representational structure supports the comparison required for that purpose while leaving other relevant dimensions unordered, unrepresented, or intentionally outside the comparison.

Partial commensurability makes room for ordinary institutional practice without turning every workable comparison into a claim of total equivalence. It also makes visible a central justice question: which dimensions are selected for comparison, which are omitted, and who has authority to determine the selection? A conversion can be procedurally regular under its adopted metric while remaining contested because the metric excludes relations that affected parties regard as relevant.

The construction of a common metric can therefore generate benefits and losses simultaneously. It can lower coordination costs, support accountability, make settlement possible, and reduce ambiguity. It

can also compress context, privilege readily measurable features, or shift authority toward actors able to define the metric. These effects do not determine whether commensuration is just. They identify the institutional consequences that later normative sections will evaluate.

2.3 Conversion beyond Numerical Exchange

Conversion is broader than the assignment of a numerical ratio. The term is used here for processes in which a value represented in one form becomes actionable, transferable, compensable, settleable, or institutionally consequential through another form. Numerical exchange is one important subtype. Other cases involve changes in rights, classifications, obligations, recognition, or practical possibilities.

Definition 2.4 (Heterogeneous value conversion). A *heterogeneous value conversion* is a historically situated process through which a value represented within one relational or institutional structure is connected to another value form in a way that changes what can be compared, transferred, claimed, settled, compensated, recognized, or acted upon.

This definition includes at least four analytically distinct operations. First, *translation* changes the representational language in which a value is expressed. Second, *commensuration* supplies enough common structure for comparison. Third, *conversion* establishes a practical relation across value forms. Fourth, *settlement* gives that relation institutional consequence by discharging, creating, transferring, or modifying claims and obligations. Real processes can combine these operations, and the sequence can matter.

For example, labor-to-wage conversion can involve identification of the work, classification of the position, attribution of contribution, negotiation or administrative pricing, contractual authorization, monetary payment, and the alteration of future rights and obligations. Environmental compensation can involve identification of affected entities, selection of ecological or legal indicators, valuation, determination of liability, payment or restoration, and subsequent monitoring. Currency conversion can involve quotation, liquidity provision, settlement infrastructure, legal accessibility, and exposure to future exchange-rate movements. Each case contains more structure than a final ratio records.

The broader definition also clarifies why the endpoint of conversion may differ from substitution. A payment can settle a claim while leaving the original loss historically irreversible. Recognition can alter status without recreating a lost opportunity. A property transfer can exchange legal control while preserving continuing ecological or social relations around the asset. Conversion justice therefore cannot be inferred solely from whether an institution has successfully completed the conversion procedure.

The shorthand $A \rightsquigarrow B$ is used throughout the paper when a compact notation is helpful. The symbol indicates a conversion relation whose internal history is left open at that level of description. It carries no assumption of identity, full commensurability, or a context-free scalar transformation between A and B .

2.4 Spatiotemporal Dependence of Conversion

Conversion conditions depend on the relational configuration in which the conversion occurs. Prices, wages, compensation standards, exchange rates, institutional categories, bargaining positions, legal entitlements, and the practical meaning of a monetary amount can vary across location, historical period, regulatory system, technological environment, and international relationship. Spatiotemporal dependence therefore enters conversion at several levels simultaneously.

One level concerns the values themselves. A unit of labor time can involve different productive technologies, social protections, skill histories, or physical burdens across contexts. A monetary amount can support different purchasing possibilities and expose its holder to different monetary risks. An ecological resource can have different substitution possibilities depending on local geography and infrastructure. The value form entering conversion is therefore historically situated even when its nominal label remains stable.

A second level concerns the conversion interface. The institutions that recognize a claim, define a category, supply liquidity, establish a legal remedy, or authorize settlement can change. The same pair of nominal values can therefore be connected through different procedures and power relations. Conversion rules that were workable under one institutional environment may become inaccessible or normatively contested after political, technological, ecological, or international change.

A third level concerns the consequences of conversion. The same transfer can generate different effects on capability, dependency, risk exposure, exit options, or future bargaining power because the surrounding relational field differs. This is especially visible in monetary cases. A fixed nominal amount can have different domestic purchasing power, international convertibility, or capacity to absorb future shocks across places and periods. The conversion ratio records one relation while the later consequences depend on a larger structure.

For the present paper, spatiotemporal dependence does not require a claim that every conversion lacks stable features. Stable conventions, durable institutions, network effects, and historically persistent standards can make some conversion relations robust across wide ranges of conditions. The analytical point is narrower: robustness is itself a property of a relational and historical configuration and should be distinguished from context independence.

The four distinctions developed in this section establish the basis for the rest of the paper. Heterogeneous value identifies the plurality of relational structures entering conversion; commensuration specifies the construction of a common comparison basis; heterogeneous conversion concerns the practical transformation across value forms; and spatiotemporal dependence situates the process within evolving historical and institutional conditions. Section 3 develops the relational constitution of the values, subjects, and attribution structures that participate in such conversions.

3 Relational Constitution of Conversion

This section develops the relational constitution of the values and participants that enter heterogeneous conversion. Its role is to clarify what is being converted as a basis for the epistemic analysis in Section 4, the monetary analysis in Section 5, and the procedural and normative analyses developed in Sections 7 and 9. The discussion proceeds through four analytical steps. It first treats value as historically embedded rather than as an isolated attribute. It then distinguishes subjects, holders, and other relations affected by conversion. The third subsection addresses co-generation and the problem of attribution. The final subsection characterizes conversion as a transformation of a wider relational configuration. The analysis remains conceptual and uses the formal vocabulary of the companion formalism only where it clarifies the normative problem.

3.1 Values within Relational Histories

A value entering conversion is usually encountered through a present form: a wage claim, a price, a legal entitlement, a credit balance, a parcel of land, a scientific contribution, an ecological service, or another institutionally recognizable object. The present form can obscure the history through which the value became available for conversion. Labor capacity depends on prior education, care, health, infrastructure, organizational routines, technologies, and accumulated knowledge. Monetary claims depend on legal, fiscal, banking, and payment institutions. Environmental values depend on ecological processes whose relevant timescales can substantially exceed those of the transaction that later represents them.

The present discussion therefore treats value as relationally constituted in a modest sense. A value manifestation is understood through the relations that make its present significance and convertibility possible. This formulation does not require the claim that one complete relational genealogy can be recovered for every value. It requires only that the visible conversion object can be analytically incomplete when detached from the history and surrounding structures that sustain it.

Definition 3.1 (Relationally constituted value). A *relationally constituted value* is a value manifestation whose practical significance, recognizability, or capacity for conversion depends materially on a historically situated configuration of relations.

Definition 3.1 is intentionally broad. It does not specify a universal theory of value and does not imply that every relation in the history is equally relevant to every evaluative question. Its analytical purpose is to prevent the conversion object from being treated automatically as a self-contained unit whose present label exhausts the conditions of its production, recognition, and use.

This distinction matters because different historical routes can lead to similar present manifestations. Two workers may receive the same wage while arriving at the employment relation through different educational, familial, legal, or migration histories. Two monetary claims with the same nominal amount may be embedded in different currency systems, jurisdictions, or liquidity conditions. Two parcels of land with similar market prices may occupy different ecological or cultural relations. A conversion procedure that observes only the present label can therefore collapse histories that remain relevant under some theories of justice.

Relational history also complicates the temporal location of value. Some contributions are contemporaneous with the visible production event, while others are inherited from earlier institutional, technological, ecological, or intellectual processes. The contribution of past relations need not generate a current claim under every normative theory. It nevertheless affects the description of how a value became possible. The normative question of which historical contributions should count therefore follows an epistemic and attributional question about which contributions can be identified in the first place.

Figure 1 summarizes the section's central distinction. A visible value form is shown as a local manifestation within a broader relational history. Conversion acts on the manifested value while potentially altering several relations that extend beyond the immediate holder-to-holder transfer.

3.2 Subjects, Holders, and Affected Relations

Conversion language often assigns value to a holder: a worker owns a claim to wages, a seller owns an asset, a creditor holds a debt claim, or a community is associated with a cultural or ecological value. These relations are institutionally useful, yet the holder category can perform several different functions. It can denote legal ownership, practical control, experiential bearing, productive participation, entitlement to proceeds, or exposure to consequences. Conversion justice becomes difficult when these functions are treated as though they coincide automatically.

A distinction among several relational positions is therefore useful. Table 2 separates legal holding, generative participation, experiential bearing, decision authority, and affectedness. A single person or organization may occupy several positions at once, while one value can involve different persons or collectives in each position.

The distinction in Table 2 has two implications. First, the visible contracting parties do not necessarily exhaust the relational field affected by a conversion. A wage contract directly concerns worker and employer, yet it can also alter household time, care relations, occupational risk, tax obligations, and organizational dependencies. A currency conversion directly connects monetary positions while also exposing actors to payment infrastructures, legal jurisdictions, and exchange-rate movements. An environmental settlement can transfer money between recognized parties while leaving ecological effects distributed across a much larger set of relations.

Second, the category of subject should be used carefully. Within a Generative Relational vocabulary, a subject can be represented as a history-bearing relational formation rather than as an isolated point. This representation does not dissolve individual agency. It places agency within the conditions through which capabilities, claims, identities, and options develop. The same individual can therefore occupy different relational positions across different conversions, and the same conversion can involve several overlapping subjects whose histories cannot be reduced to a single holder relation.

The concept of affected relations is particularly important for justice because conversion can modify future possibilities without transferring a directly observable value to every affected party. A factory

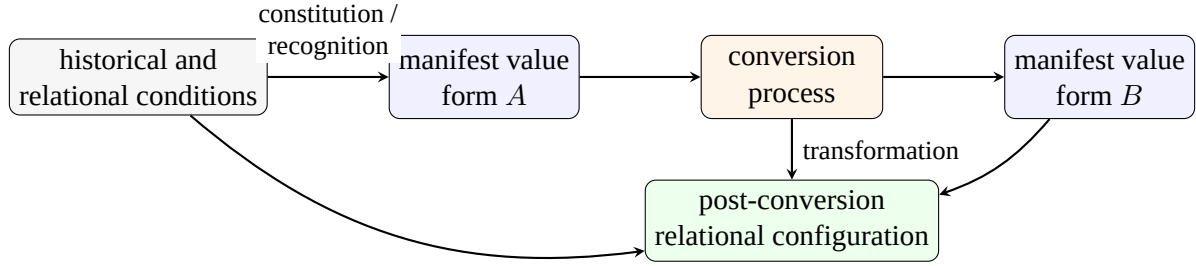


Figure 1: Relational constitution and conversion. The visible relation between value forms A and B is embedded in historical conditions and can alter a wider post-conversion relational configuration. The diagram is schematic and does not impose a single causal decomposition.

Table 2: Relational positions surrounding a conversion object. The categories can overlap and do not by themselves determine normative entitlement.

Relational position	Analytical question	Illustrative form
Legal holder	Who is institutionally recognized as owning or controlling the relevant claim or asset?	Employee wage claim, title holder, creditor, account holder
Generative participant	Which persons, institutions, material processes, or relations contributed to the production or maintenance of the value?	Team labor, prior knowledge, infrastructure, ecological process
Experiential bearer	Who directly experiences the benefit, burden, loss, or significance connected to the value?	Injured person, resident, caregiver, user community
Decision authority	Who can authorize, refuse, price, classify, or revise the conversion?	Employer, court, regulator, platform, contracting parties
Affected relation	Which additional persons, communities, institutions, or environments are altered by the conversion or its consequences?	Household, local community, supply network, ecosystem, future users

sale can alter employment relations, local tax bases, supplier dependencies, or land use. A licensing agreement can change access to knowledge even where the contractual payment occurs only between two legal entities. A debt restructuring can redistribute risk across creditors, employees, taxpayers, or public institutions. Normative analysis therefore requires some account of the relational perimeter within which consequences are considered relevant.

That perimeter cannot be fixed universally by the present framework. Different justice theories can identify different affected relations, and practical institutions operate under finite informational constraints. The framework therefore treats the scope of affectedness as an explicit analytical choice whose justification belongs to later epistemic and normative analysis.

3.3 Co-Generation and Attribution

Many conversion objects arise through co-generation. A product can combine current labor, accumulated technical knowledge, finance, organizational coordination, public infrastructure, ecological inputs, and prior investment. A scientific contribution can depend on earlier literature, laboratories, datasets, software, institutional funding, peer interaction, and educational histories. A currency's practical convertibility can depend on legal authority, banking networks, market liquidity, public credibility, inter-

national use, and payment infrastructure. Co-generation therefore concerns the plurality of relations through which a presently identifiable value becomes possible.

Attribution is the institutional or epistemic operation through which some of these generative relations are associated with particular persons, organizations, causes, or value shares. Attribution is necessary for many practical purposes. Wages, royalties, damages, taxes, ownership claims, authorship, and accounting all require some way of assigning responsibility, contribution, or entitlement. The difficulty is that attribution can be substantially narrower than the generative history it summarizes.

Definition 3.2 (Attribution structure). An *attribution structure* is a context-dependent scheme that associates a generated value, contribution, burden, or claim with selected persons, organizations, processes, or relations for a specified institutional or evaluative purpose.

Definition 3.2 separates co-generation from attribution. Co-generation concerns the relational history through which a value emerges. Attribution concerns the subsequent selection of relations that count for a particular accounting, legal, political, or normative purpose. The two can overlap closely in some cases and diverge substantially in others.

This separation creates a distinct site of justice. A conversion can operate according to a regular pricing or compensation rule while the attribution structure that feeds into the rule systematically omits relevant contributors. Conversely, a broad historical account of contribution does not by itself determine how current benefits or obligations should be allocated. Some contributions may be too diffuse for individualized return; some may be publicly financed; some may be nonhuman; and some may have occurred in distant historical periods. The transition from generative history to normative claim therefore requires additional judgment.

Attribution also interacts with power. Actors with greater institutional legibility can be better positioned to have their contributions recorded, priced, protected, or converted. Formal ownership documents, recognized professional categories, standardized metrics, and contractual records can make some relations highly visible. Care, tacit knowledge, ecological support, informal labor, and historical dependency can remain less legible. These differences motivate the epistemic analysis developed in Section 4.

For the purposes of the present paper, the normative significance of co-generation is therefore left open. The claim is limited to analytical sequencing: conversion justice can depend on which generative relations are recognized, how they are attributed, and which attribution structure a conversion rule treats as authoritative.

3.4 Relational Transformation in Conversion

The final step is to situate conversion within a changing relational configuration. The visible exchange can be represented compactly as $A \rightsquigarrow B$, yet the practical process can change ownership, obligations, expectations, institutional status, access, dependency, risk exposure, and future options. Conversion is therefore analytically richer when treated as a relational transformation whose consequences extend beyond the represented value forms.

A labor-to-wage conversion illustrates the point. Payment changes the worker's monetary position and can discharge the employer's contractual obligation. The same event may also reproduce an employment relation, alter household resources, affect future bargaining power, change eligibility for benefits, and expose the worker to new occupational risks or opportunities. Whether these effects are normatively salient depends on the evaluative theory, but they remain part of the relational history produced by the conversion.

A currency conversion provides another example. The final quotation records a relation between monetary units. The transaction can simultaneously change portfolio exposure, liquidity, jurisdictional dependency, settlement risk, and vulnerability to later exchange-rate movements. A conversion that appears symmetric at the level of a quoted ratio can therefore generate asymmetric consequences when the parties occupy different positions in the monetary system.

Environmental compensation makes the distinction especially visible. A monetary payment can create a legally recognized settlement while the ecological process associated with the original loss continues

along another timescale. The conversion can therefore close one institutional relation while leaving other material or ecological relations open. The fairness of the monetary amount is only one dimension of the normative problem.

This relational-transformation view also clarifies why equivalent endpoints can conceal different histories. Two conversions can produce the same nominal payment while differing in recognition, bargaining conditions, attribution, timing, risk, or later relational effects. A justice analysis that observes only the final allocation can therefore miss distinctions that procedural, epistemic, capability-oriented, relational, or historical theories consider important.

The present section establishes the analytical object on which later normative assessments can operate while leaving the selection of normatively relevant surrounding relations theory-relative. Conversion connects historically constituted values, subjects, holders, institutions, and affected relations; it operates through attribution and commensuration; and it can modify the relational field in which subsequent judgments and conversions occur. Section 4 examines the epistemic conditions under which these relations become identifiable and institutionally legible.

4 Epistemic Conditions of Conversion

The preceding sections treated heterogeneous conversion as a relational process whose visible endpoints depend on wider histories of generation, attribution, institutional recognition, and affected relations. The present section isolates the epistemic layer of that process. Its objective is to clarify how a conversion procedure comes to identify the entities, properties, histories, and claims that it subsequently compares or transforms. The argument is analytical rather than comprehensive: it distinguishes entity identification, institutional legibility, historical truncation, attribution under partial knowledge, and epistemic injustice as separate but interacting sites at which conversion can be shaped before a price, ratio, compensation rule, or settlement is applied.

A central premise is that practical conversion operates on finite representations of a larger relational history. No institution, market participant, evaluator, or legal procedure has access to every relation that contributed to the emergence of a value. Conversion therefore requires selective identification. The resulting representation can be adequate for one purpose while omitting relations that matter for another. The normative issue begins when these epistemic selections become consequential for recognition, attribution, access, compensation, or settlement.

4.1 Entity Identification

Heterogeneous conversion presupposes an answer to a prior question: which entity is being converted, compensated, priced, recognized, or transferred? In simple transactions this question can appear trivial. A commodity may be represented by a standardized unit, a currency by an account balance, or a labor contract by recorded hours. In more relational cases, however, the practical entity is the result of an identification procedure that selects some features and relations while leaving others outside the operative representation.

For discussion, let ω denote the relevant relational configuration and let $\mathcal{I}_a^{(c)}$ denote an identification map used to construct an entity associated with focal referent a under context c . The role of the map is stated in Equation 1.

$$\mathcal{I}_a^{(c)} : \Omega \longrightarrow \mathfrak{E}, \quad \hat{E}_a^{(c)} = \mathcal{I}_a^{(c)}(\omega). \quad (1)$$

Here $\mathfrak{E}$ denotes a space of identified relational entities for the purposes of the present discussion. The hat on $\hat{E}_a^{(c)}$ marks the distinction between the practically identified entity and any stronger claim that the representation exhausts the relational existence of a .

Definition 4.1 (Conversion-relevant entity identification). *A conversion-relevant entity identification is a context-dependent epistemic procedure that selects a finite relational representation to serve as an input to a conversion, attribution, recognition, or evaluation process.*

Definition 4.1 makes entity identification prior to conversion without making it metaphysically prior to the entities themselves. The identified entity can include a focal object, surrounding relations, historical contributions, legal attributes, ecological dependencies, or institutional statuses according to the purpose of the conversion. A wage calculation may identify labor through time, task, role, and contract category. An environmental compensation procedure may identify a loss through acreage, species, ecosystem function, property rights, and temporal horizon. An intellectual-contribution dispute may identify a contribution through authorship records, conceptual input, code commits, institutional affiliation, or prior knowledge.

Identification is therefore neither arbitrary nor complete. Practical systems require boundaries, yet the chosen boundaries can carry normative consequences. If the representation of a worker includes only recorded hours, relations such as occupational risk, care obligations, training history, or dependency on collective infrastructure may remain outside the conversion interface. Their exclusion can be appropriate for some accounting purposes and consequential for some justice questions. The formal distinction allows these two statements to coexist.

4.2 Recognition and Institutional Legibility

Identification becomes practically consequential when institutions recognize some descriptions as legible inputs to decision. Classification systems, standards, legal categories, professional credentials, accounting conventions, and evidentiary formats determine which distinctions can enter an institutional process. Bowker and Star’s analysis of classification systems emphasizes that standards and categories form part of information infrastructures and can privilege some perspectives while rendering others less visible [5]. The relevance to heterogeneous conversion is direct: a conversion interface can operate only on distinctions that its institutional vocabulary can register.

Institutional legibility is therefore more specific than general observability. A person may know that an activity involved substantial tacit knowledge while a wage schedule recognizes only a job classification. A community may describe a landscape through historical, spiritual, ecological, and subsistence relations while a compensation procedure recognizes land title and assessed market value. A scientist may understand a contribution as collectively generated while an intellectual-property regime requires assignment to identifiable legal persons or entities.

Definition 4.2 (Institutional legibility). *Institutional legibility* is the degree to which an identified relation, attribute, history, or claim can enter the recognized categories, evidentiary procedures, and decision rules of a particular institutional conversion setting.

Legibility can increase practical coordination. Standardized units, categories, and records allow large systems to compare cases and settle claims. The same simplification can also narrow the informational basis on which conversion occurs. The relevant justice question is therefore not whether institutional simplification exists, but which simplifications become consequential, who can contest them, and whether omitted relations have alternative routes to recognition.

Table 3 summarizes several recurrent epistemic distortions that can arise between a wider relational history and the entity made legible for conversion. The categories are analytical and can overlap in concrete cases.

The table also clarifies why greater informational detail does not automatically produce greater justice. A conversion system can collect large quantities of data while preserving a problematic classification scheme. Conversely, a deliberately coarse representation can be appropriate when the omitted detail is irrelevant to the decision. Epistemic adequacy is therefore purpose-sensitive and theory-sensitive.

4.3 Historical Truncation

Historical truncation is especially important in a Generative Relational analysis because present entities are treated as historically constituted. A conversion procedure typically encounters a current representa-

Table 3: Epistemic distortions relevant to heterogeneous conversion.

Distortion	Epistemic structure	Possible conversion consequence
Omission	A relevant relation or contribution remains outside the operative representation.	The conversion proceeds without registering a burden, contribution, dependency, or claim.
Fragmentation	A connected relational history is represented as several unrelated units.	Co-generation or shared dependency can disappear from attribution and compensation.
Conflation	Distinct relations are compressed into one category.	Heterogeneous burdens or contributions can receive the same conversion treatment.
False connection	A relation is inferred or institutionally imposed where the underlying support is weak.	Responsibility, entitlement, or causal contribution can be assigned to an inappropriate entity.
Historical truncation	The representation captures a current state while excluding relevant generative history.	Present holdings or statuses can appear self-contained despite historically produced dependencies.
Scale mismatch	The observation scale differs from the scale at which the relevant process operates.	Local conversion rules can overlook system-level effects, or aggregate metrics can erase local variation.

tion: a wage rate, ownership record, credential, asset, debt, contract, ecological condition, or currency position. The current state can conceal the history through which that state became possible.

A minimal representation of truncation can distinguish a selected historical window from a wider relational history. Let $D(\Sigma)$ denote the history available up to a relational slice Σ , and let $W_h \subseteq D(\Sigma)$ denote the finite historical domain admitted by an identification procedure. The restricted representation is stated in Equation 2.

$$\widehat{E}_{a,h}^{(c)} = \mathcal{I}_a^{(c)}(\omega|_{W_h}), \quad W_h \subseteq D(\Sigma). \quad (2)$$

Equation 2 does not imply that more distant history is always normatively relevant. It makes explicit that a historical horizon has been selected. The selection can then be defended, revised, or contested according to the conversion problem.

Historical truncation matters because the same present configuration can support different normative interpretations when its genealogy differs. Two holdings of equal monetary value can arise through different histories of inheritance, labor, public subsidy, coercion, ecological extraction, or voluntary exchange. Two apparently similar credentials can emerge from unequal access to education and institutional support. A land title can be formally clear while the longer history of displacement, stewardship, or communal use remains contested. The conversion process need not resolve these histories automatically, yet a justice analysis should be able to state when the historical horizon is doing normative work.

The temporal problem also affects retrospective conversion. Later evidence can alter what an institution recognizes about an earlier event, such as an overlooked contribution, previously unrecorded harm, or later-discovered environmental consequence. The historical event itself need not be treated as rewritten for the analysis to change. A later recognition event can expand the currently available relational representation and thereby reopen attribution, compensation, or settlement questions.

4.4 Attribution under Partial Knowledge

Attribution translates an identified relational history into claims about contribution, responsibility, ownership, entitlement, or burden. Because identification is partial, attribution inherits epistemic uncertainty.

This point is important for heterogeneous value conversion because the conversion rule may be regular while the attribution structure feeding into it is incomplete.

Consider a collectively produced value. The observable outcome may be associated with a formal author, employer, property owner, patent holder, contractor, or organizational unit. The generative history can include additional labor, tacit knowledge, care, infrastructure, ecological inputs, public investment, and prior intellectual work. Practical institutions cannot assign individualized shares to every contributing relation. They therefore select an attribution rule from a partial informational basis.

This selection can be represented schematically by an attribution map $\alpha^{(c)}$ acting on an identified entity. Equation 3 states the structure.

$$\alpha^{(c)} : \mathfrak{E} \longrightarrow \mathfrak{A}, \quad A_a^{(c)} = \alpha^{(c)} \left(\widehat{E}_a^{(c)} \right), \quad (3)$$

where $\mathfrak{A}$ denotes a space of attribution structures relevant to the application. Equation 3 separates two possible sources of disagreement. Parties may disagree about the identified entity $\widehat{E}_a^{(c)}$, or they may accept the same identified entity and disagree about the attribution rule $\alpha^{(c)}$.

The distinction is useful in practical disputes. An employee and employer may agree on the documented tasks while disagreeing about the contribution those tasks made to a profitable outcome. A community and public authority may agree on observed environmental changes while disagreeing about responsibility or entitlement to compensation. Scientific collaborators may agree on a project history while disagreeing about how that history should be converted into authorship order or credit. Epistemic uncertainty and normative disagreement can therefore coexist without being identical.

Attribution under partial knowledge also creates a temporal asymmetry. Some contributions become visible only after conversion has already occurred. Later recognition can support restitution, revision, acknowledgment, or renewed bargaining, yet each remedy depends on institutional rules governing reopenability. The epistemic problem therefore connects directly to the procedural issues developed later in the paper.

4.5 Epistemic Injustice in Conversion

Epistemic injustice provides one established normative vocabulary for examining how persons can be wronged in their capacity as knowers. Fricker distinguishes testimonial injustice, involving an unfair credibility deficit, and hermeneutical injustice, involving structural disadvantages in making significant social experiences intelligible [12]. The present discussion does not reduce conversion-related epistemic problems to these two forms. It uses the broader insight that epistemic standing, interpretive resources, and credibility can shape materially consequential decisions.

Within heterogeneous conversion, epistemic injustice can enter through several routes. A worker's testimony about risk can receive insufficient credibility during compensation or workplace evaluation. A community can lack institutionally recognized concepts for expressing a loss that does not fit prevailing monetary or legal categories. Informal contributors can be excluded because their participation left little documentary trace. Historical relations can be absent from the records accepted by a settlement process. Expert vocabularies can also make some claims highly legible while making experiential or local knowledge difficult to translate into the conversion interface.

Claim 4.3 (Epistemic conditioning of conversion). When a conversion depends on institutionally selected representations of entities, histories, contributions, or harms, the epistemic conditions governing those representations can become part of the justice problem associated with the conversion.

Claim 4.3 is deliberately conditional. It does not imply that every omission constitutes injustice or that complete representation is possible. It identifies a site of normative analysis: if an epistemic asymmetry systematically changes who becomes recognizable, credible, attributable, compensable, or able to contest conversion, then the fairness of the final ratio cannot be assessed independently of that epistemic architecture.

This observation also limits a common response to heterogeneous conversion problems. Improving the numerical precision of a conversion rule cannot repair an upstream identification error by itself. A compensation formula can be applied perfectly to an incorrectly delimited harm. A wage schedule can be internally consistent while relevant work remains unrecognized. A currency conversion can be technically exact while one party lacks information about risks, alternatives, or settlement conditions. Quantitative accuracy and epistemic justice therefore address different layers of the process.

The present section leaves the governing epistemic standards theory-relative. Different approaches can prioritize testimony, participatory knowledge, documentary evidence, expertise, historical reconstruction, structural fidelity, or other epistemic goods. The narrower conclusion is that heterogeneous conversion requires an account of how entities and claims become knowable before their values are compared or transformed. Section 5 applies this epistemic architecture to a prominent conversion institution: money as a common equivalent and currencies as heterogeneous monetary forms embedded in international relations.

5 Common Equivalence and Monetary Conversion

Money provides an especially important case of heterogeneous value conversion because it combines two operations that are often analytically separated. Within a monetary domain, heterogeneous goods, services, labor, claims, and obligations can be expressed through a common unit of account. Across monetary domains, the monetary units themselves become heterogeneous and require further conversion. The present section examines this layered structure and its implications for conversion justice. Its objective is conceptual rather than monetary-theoretic: established economics and international political economy provide the primary explanations of price formation, exchange rates, liquidity, reserve allocation, and currency internationalization, while the Generative Relational discussion focuses on how these mechanisms reorganize the conversion interface through which heterogeneous values become mutually legible.

The discussion proceeds through five steps. It first treats money as a common equivalent and distinguishes this role from a claim that money exhausts the value of what it prices. It then considers currency conversion as a second-order problem of equivalence among monetary units. The third subsection examines international currency hierarchy and the political-economic relations supporting it. The fourth introduces relational stability as a limited analytical concept for describing monetary forms whose convertibility or recognizability remains comparatively robust across some classes of relational disturbance. The final subsection returns to labor and shows why a nominal monetary conversion does not, by itself, settle questions of purchasing power or justice across different spatiotemporal contexts.

5.1 Money and Common Equivalence

The familiar economic functions of money provide a first entry into common equivalence. Contemporary central-bank explanations typically distinguish money's functions as a medium of exchange, unit of account, and store of value [9]. For heterogeneous conversion, the unit-of-account function is particularly important because it permits unlike goods and services to be expressed within a shared numerical denomination. A meal, an hour of labor, a train ticket, a legal fee, and an industrial component can all receive monetary prices even though the underlying objects, activities, and relations remain heterogeneous.

A classic Marxian formulation described money as the *general equivalent*: a monetary form through which the values of heterogeneous commodities receive a common expression [15]. The present paper uses this historical idea only to identify the conversion structure; it does not adopt the labor theory of value or imply that heterogeneous values possess one metaphysically prior magnitude waiting to be revealed by money. The analytical point is narrower: monetary denomination creates a common representational interface through which heterogeneous objects can enter comparison, payment, accounting, taxation, contracting, or exchange.

For discussion, let $\mathfrak{V}^{(c)}$ denote the set of value-objects rendered monetarily legible under context c , and let M denote the relevant monetary unit. A monetary denomination map is stated in Equation 4.

$$\mu_M^{(c)} : \mathfrak{V}^{(c)} \longrightarrow \mathbb{R}_M, \quad v \longmapsto p_M^{(c)}(v). \quad (4)$$

Equation 4 represents a practical pricing or accounting relation. It does not assert that $\mu_M^{(c)}$ is injective, lossless, or normatively complete. Distinct values can receive the same price, one value can receive different prices under different institutions or moments, and some value dimensions can remain intentionally outside monetary conversion.

Money’s capacity to operate as a common equivalent is itself historically and institutionally produced. Desan’s historical account emphasizes that monetary design is embedded in political and legal arrangements and that changes in how money is made can reshape market relations [8]. The present framework therefore treats monetary commensuration as an achieved relational infrastructure rather than a neutral metric supplied independently of institutions. Legal tender rules, banking systems, payment networks, taxation, accounting practices, confidence, contractual enforcement, and repeated use contribute to the practical capacity of a monetary unit to serve as a common denominator.

This distinction matters for justice. Once v has been assigned $p_M(v)$, the existence of a price establishes a conversion convention; it does not establish that the convention captures every normatively relevant property of v . Monetary commensuration can be indispensable for practical coordination while remaining partial as a representation of care, ecological continuity, historical meaning, bodily burden, knowledge, dignity, or future opportunity. Conversion justice therefore begins from the existence of the monetary interface without identifying that interface with a complete theory of value.

Figure 2 summarizes the layered structure developed in this section. Monetary equivalence operates within domestic pricing and payment systems, while international monetary conversion adds another layer in which currencies themselves become objects of comparison and transformation.

5.2 Heterogeneous Currencies and Higher-Order Equivalence

Once several currencies coexist, the common-equivalent problem reappears at another level. A currency can serve as a domestic unit of account and medium of settlement while remaining only partially usable outside its issuing monetary system. Cross-border exchange therefore requires relations among monetary units, and those relations differ in liquidity, market depth, convertibility, settlement infrastructure, legal accessibility, and acceptance.

For two monetary units M_i and M_j , let e_{ij} denote a quoted conversion rate under a specified market and moment. The elementary monetary conversion is stated in Equation 5.

$$q_j = e_{ij}q_i, \quad (5)$$

where q_i and q_j are monetary amounts denominated in M_i and M_j , respectively. Equation 5 describes a numerical conversion once the currencies, quotation convention, market, settlement conditions, and timing are fixed. It does not describe the wider relations that make the quotation available.

International conversion is frequently organized around a smaller set of widely used currencies. In foreign-exchange markets, a currency can function as a *vehicle currency*: two other currencies can be exchanged through an intermediate currency because the corresponding markets are deeper or more liquid. BIS evidence shows that international monetary use is highly concentrated and that the U.S. dollar occupies the leading position across multiple international markets, including foreign-exchange, funding, and trade-related activity [16]. Cohen’s political-economic account likewise emphasizes differentiated international currency roles and a hierarchy of monetary use rather than a flat field of equivalent national monies [7].

The phrase *higher-order equivalence* is used here as analytical shorthand for this recursive structure. It is not proposed as a standard term in monetary economics. At one level, heterogeneous goods and obligations are rendered commensurable through a money. At another level, heterogeneous monies are

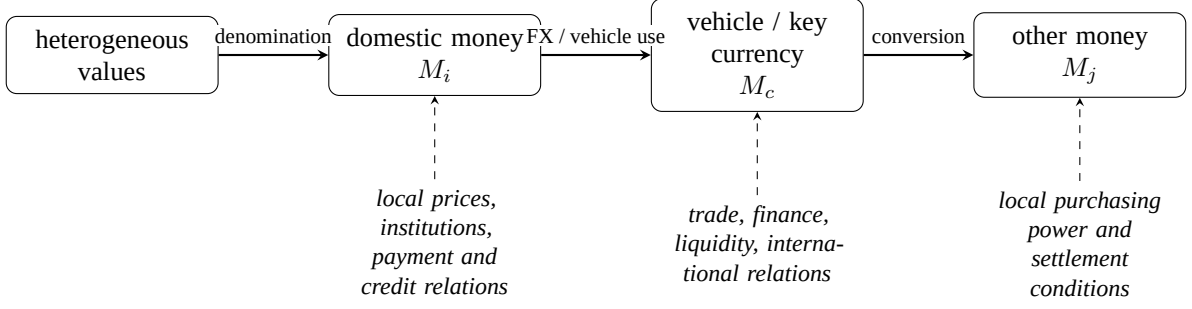


Figure 2: A layered representation of monetary equivalence. Heterogeneous values can first be denominated in a domestic money, while heterogeneous monies can subsequently be converted through international monetary relations. Dashed arrows indicate relational conditions that support each monetary position. The diagram is analytical and does not imply that every transaction follows a vehicle-currency path.

themselves rendered convertible, and a small subset can acquire disproportionate importance as common denominators for trade, finance, reserves, or settlement. A vehicle-currency path can be represented by the composition in Equation 6.

$$\chi_{ij}^{(c)} = \chi_{cj} \circ \chi_{ic}, \quad (6)$$

where χ_{ic} and χ_{cj} denote admissible conversion maps through key currency M_c . Equation 6 is schematic: direct conversion may also exist, and the economically relevant route depends on liquidity, spreads, regulation, payment infrastructure, and transaction size.

The recursive structure matters because common equivalence is no longer merely a property of a token or unit. It becomes a property of a conversion network. A monetary unit can be numerically exchangeable against many currencies while still occupying a peripheral relational position if those exchanges are costly, illiquid, restricted, or operationally dependent on another unit. Conversely, a currency can become central because its widespread use creates thick markets, lowers transaction costs, and reinforces subsequent use. The common equivalent is therefore also a network position reproduced through repeated conversion.

5.3 Currency Hierarchy and International Relations

International currency hierarchy connects monetary conversion to political economy. Currencies differ in their use for invoicing, settlement, funding, foreign-exchange trading, reserve management, and denomination of financial claims. These functions are related but analytically distinct. A currency can be important in one role while remaining limited in another, and the institutional conditions supporting each role can differ [7].

Contemporary BIS statistics illustrate the asymmetry. The dollar occupies the leading position across the international markets surveyed by the BIS; its use in trade invoicing, global funding, and foreign-exchange markets generates network externalities that further support its international role [16]. For the present paper, this empirical ranking serves to show that currencies that are formally convertible can occupy substantially different positions within the conversion infrastructure; the ranking itself supplies no normative verdict.

International relations enter this infrastructure through several channels. Monetary use can depend on confidence in legal and financial institutions, access to payment and settlement systems, capital-market depth, trade relations, regulatory arrangements, reserve practices, and expectations about future access. Political relations can therefore alter the effective conversion environment even when the nominal monetary unit remains unchanged. A deterioration in cross-border relations can affect capital flows, sanctions exposure, settlement accessibility, reserve composition, or risk premia; cooperative arrangements can facilitate payment integration, swap access, convertibility, or institutional interoperability. The importance

of these channels varies across currencies and historical periods.

This perspective also separates monetary hierarchy from a simple ranking of exchange-rate levels. A currency with a high unit price against another currency is not thereby an internationally central currency. International centrality concerns the density and importance of the relations organized through the unit. A currency can depreciate while retaining a major role in invoicing, funding, or settlement, and another currency can appreciate without acquiring comparable network centrality. Conversion power is therefore relationally distinct from the nominal price of a currency.

Table 4 distinguishes several layers that are often compressed into the phrase “currency value.” The layers interact, but they answer different analytical questions.

Currency hierarchy can create asymmetric exposure to changes in the international monetary environment. Borrowers whose liabilities are denominated in a dominant foreign currency, firms whose trade is invoiced in that currency, and central banks managing reserves can all experience consequences from policies and exchange-rate movements originating outside their domestic monetary system. BIS work emphasizes that currency composition shapes balance-sheet valuation, funding conditions, and macroeconomic transmission [16]. These asymmetries become normatively relevant only after a theory specifies why a particular exposure, dependency, or distribution of risk is unjust; the descriptive hierarchy alone does not supply that conclusion.

5.4 Relational Stability and Monetary Invariance

The discussion of currency hierarchy also motivates a distinction between price stability and relational stability. A monetary asset can fluctuate substantially in market price while preserving broad recognizability, convertibility, or acceptability across many relational changes. Conversely, a nominally stable asset can become difficult to convert if payment channels, legal access, counterparties, or institutional confidence deteriorate. The present subsection uses *relational stability* to refer to robustness of a selected monetary capability across a specified class of relational transformations.

Let $\kappa_M(\omega)$ denote a selected monetary capability in configuration ω , such as convertibility, market access, settlement usability, or recognizability. For a class $\mathcal{T}$ of relational transformations, a limited invariance condition can be written as Equation 7.

$$d_\kappa(\kappa_M(\omega), \kappa_M(T\omega)) \leq \varepsilon, \quad T \in \mathcal{T}. \quad (7)$$

Equation 7 is a proposed analytical descriptor rather than an empirical law. The metric d_κ , transformation class $\mathcal{T}$, and tolerance ε must be specified for the application. The expression therefore does not claim that money possesses an invariant intrinsic value. It asks whether a selected monetary function remains comparatively robust under selected changes in the surrounding relational field.

Gold provides a useful illustration of the distinction. Gold prices are volatile, and gold does not offer the same liquidity characteristics as cash or highly liquid government securities. Yet reserve managers can value gold partly because it is not a claim on the same type of sovereign issuer as a foreign-currency security and can diversify exposures associated with monetary and geopolitical relations. An IMF working paper finds that central-bank gold accumulation has been associated with periods of economic, financial, and geopolitical uncertainty and with exposure to financial sanctions [3]. The paper is evidence about reserve behavior, not proof that gold is intrinsically stable or politically neutral.

From a relational perspective, the relevant contrast is therefore between different dependence structures. A foreign sovereign claim can be highly liquid and useful while depending on issuer credit, jurisdiction, market access, and settlement infrastructure. Physical gold has different dependencies: custody, verification, market liquidity, transport, and price risk remain relevant, while direct reliance on a particular foreign issuer is reduced. Relational stability is thus multidimensional. A resource can be robust to one class of disturbance and fragile to another.

This formulation also explains why monetary invariance should remain qualified. There is no requirement that one asset preserve every relevant function across every disturbance. The analytical task is to specify which capability is being considered and which transformations matter for the conversion

Table 4: Analytical layers of monetary equivalence and conversion.

Layer	Primary conversion problem	Representative relation	Selected relational conditions
Domestic denomination	Heterogeneous goods or claims into one unit of account	Price, wage, fee, debt, tax obligation	Legal rules, accounting, banking, expectations, domestic price structure
Cross-currency exchange	One monetary unit into another	Market exchange rate	Liquidity, interest rates, capital flows, convertibility, settlement access
International currency use	Multiple transactions organized around a key currency	Vehicle, invoicing, funding, reserve, settlement roles	Market depth, network effects, trade and financial relations, institutional confidence
Purchasing-power comparison	Monetary amounts into comparable consumption or output volumes	Purchasing power parity and price-level comparison	Domestic price levels, reference baskets, statistical conventions
Reserve robustness	Monetary claims into stores of liquidity or value with different risk structures	Foreign currency assets, gold, other reserve assets	Issuer exposure, liquidity, market access, sanctions or jurisdictional risk, portfolio objectives

problem. In this sense, relative invariance is compatible with the broader GR commitment that value and convertibility remain relationally generated.

5.5 Labor, Currency, and Spatiotemporal Conversion

Labor-to-money conversion makes the limits of nominal equivalence especially visible. A wage converts a legally and institutionally recognized labor relation into a monetary claim or payment. Yet the same nominal amount can have different purchasing power across places and historical periods, and the same duration of labor can differ in intensity, risk, skill formation, social reproduction requirements, and future opportunity. A statement such as “one day of labor equals 100 monetary units” therefore identifies a conversion outcome without exhausting the relational structure that gives the outcome practical or normative meaning.

Economics already distinguishes market exchange rates from purchasing-power comparisons. The OECD defines purchasing power parities as currency conversion rates that equalize purchasing power by controlling for price-level differences across countries [18]. This distinction is useful because a market exchange rate answers a different question from the amount of goods and services a monetary income can command in different economies. Purchasing-power adjustment can therefore correct one source of spatial incomparability without becoming a complete measure of welfare or justice.

For discussion, let w_M denote a wage expressed in currency M , and let $P^{(x,\Sigma)}$ denote a context-specific price-level or purchasing-power representation at location x and relational slice Σ . A real-purchasing representation can be written schematically as Equation 8.

$$\tilde{w}^{(x,\Sigma)} = \mathcal{P}\left(w_M, P^{(x,\Sigma)}\right), \quad (8)$$

where $\mathcal{P}$ denotes an explicitly chosen purchasing-power transformation. Equation 8 remains descriptive. It does not determine whether the transformed wage is sufficient, deserved, exploitative, capability-

enhancing, or otherwise just.

The same caution applies to the labor side of the conversion. Chronological duration provides one common representation of labor, but an eight-hour shift in different occupations, institutions, or historical conditions does not constitute one homogeneous relational object. Work can differ in bodily burden, uncertainty, danger, autonomy, required training, responsibility, opportunity cost, and effects on household or community relations. The monetary wage therefore connects two already structured sides: a relationally constituted labor process and a relationally constituted monetary unit.

International currency movements add another layer. A worker can receive the same nominal local-currency wage while the external convertibility of that wage changes because the currency depreciates, capital controls change, international prices move, or access to foreign settlement changes. The worker's labor process may remain locally similar while the international conversion possibilities associated with the wage alter substantially. This observation does not imply that a stable international purchasing value of labor exists independently of relations. It identifies the normative question more carefully: which relational changes should matter for evaluating the conversion, and how should risks generated outside the worker's control be distributed?

The currency case therefore supports the broader argument of the paper. Common equivalence enables coordination while simultaneously compressing heterogeneous relations into tractable conversion forms. Currency hierarchy, international relations, purchasing power, and historical context can then change what a nominally identical conversion does in practice. These distinctions provide the background for Section 6, which examines the *nomos* that stabilizes conversion rules and the processes through which such rules acquire, reproduce, and revise normative authority.

6 Conversion Nomos

The conversion of heterogeneous values requires more than a mechanism for moving from one value form to another. It also requires some historically effective understanding of what counts as an admissible object of conversion, which transformations are recognized, which claims are valid, which measurements are acceptable, how settlement is completed, and how disagreement can be raised. The present section uses *conversion nomos* as a compact term for this structured normative-institutional environment. Its role is analytical: it identifies the rules, conventions, expectations, classifications, and institutional supports that make a conversion intelligible and effective within a particular relational setting. The section does not treat *nomos* as a timeless external law, nor does it infer normative legitimacy from historical stabilization.

The discussion proceeds in five steps. It first distinguishes conversion rules from the institutional structures that stabilize them. It then examines normogenesis through repeated practice and recursive rule formation. The third and fourth subsections locate power in classification, commensuration, and control over conversion interfaces. The final subsection considers contestability and revisability as properties of a conversion order whose relevant values, institutions, and surrounding relations can change over time.

6.1 Conversion Rules and Institutional Stabilization

A conversion rule specifies some condition under which a transformation is treated as intelligible, admissible, or complete. Examples include a wage schedule that converts recognized labor into remuneration, an accounting rule that recognizes a particular asset value, a foreign-exchange convention that specifies settlement, or a compensation procedure that translates a legally recognized injury into an award. In practice, such rules operate within institutions that supply classifications, records, enforcement, settlement infrastructure, evidentiary standards, and expectations of continued use.

Ostrom's institutional analysis is useful for this distinction because it treats institutions as prescriptions that organize recurrent and structured interactions, while also emphasizing that the rules operating in one situation can themselves be crafted and modified in other rule-structured situations [19]. This layered view prevents conversion *nomos* from being reduced to a single explicit rule. A formally stated

rule can remain ineffective when supporting institutions are absent, while a convention can become practically binding through repeated use even before it is fully codified.

For the present discussion, let ω_Σ denote the relational configuration relevant to a conversion at slice Σ , and let $\mathfrak{N}_\Sigma$ denote the conversion nomos effective in that configuration. A nomos readout is stated in Equation 9.

$$\text{nom} : \Omega \longrightarrow \mathcal{N}, \quad \text{nom}(\omega_\Sigma) = \mathfrak{N}_\Sigma. \quad (9)$$

Equation 9 is deliberately modest. It records that an effective conversion order can be identified relative to a modeled relational configuration; it does not imply that nomos is fully observable, internally consistent, or reducible to written law.

Institutional stabilization concerns the degree to which a conversion rule becomes reproducible across repeated cases. Stabilization can involve legal codification, standardized measurement, recognized professional practice, payment infrastructure, common documentation, or widespread expectations about what counts as completion. Desan’s historical account of money illustrates how monetary forms depend on legal and political arrangements that help make particular claims and settlements recurrently effective [8]. Similar stabilization can occur outside money whenever heterogeneous values are repeatedly passed through a recognized conversion interface.

The normative status of stabilization remains separate from its descriptive effectiveness. A conversion rule can be stable because it coordinates expectations, because alternatives are costly, because institutions enforce it, or because powerful actors benefit from it. These sources of stability can overlap. The present framework therefore treats stabilization as a property to be explained before it is treated as a reason for endorsement.

6.2 Normogenesis through Repeated Practice

Conversion nomos can evolve through repeated interaction. Participants learn what forms of claim are likely to be accepted, institutions routinize successful procedures, classifications acquire practical familiarity, and exceptions can become precedents for later cases. Over time, a recurrent pattern can move from an improvised solution toward a recognized convention or formal rule. The term *normogenesis* is used here for this broader process of normative emergence and stabilization.

Repeated practice alone is insufficient to explain normogenesis. The same behavior can recur because of coercion, lack of alternatives, imitation, coordination benefits, inherited institutions, or active endorsement. Ostrom’s framework is relevant because it places rule formation within nested levels of interaction and relates institutional outcomes to community attributes and biophysical conditions as well as to explicit rule choices [19]. Within the present relational discussion, normogenesis is therefore mediated by the wider configuration: historical institutions, technologies, material constraints, ecological conditions, information structures, and previous conversion outcomes can all affect which practices become repeatable and which rules become sustainable.

A simplified cycle is shown in Figure 3. The diagram represents recurrent interaction, stabilization, institutional encoding, and contestation as mutually connected processes. It is not intended as a universal temporal sequence; in many cases several stages occur concurrently or recursively.

Figure 3 also clarifies why normogenesis should not be reduced to human–human agreement. Changes in technology, scarcity, environmental conditions, infrastructures, or international relations can alter what conversions remain feasible and which norms become salient. Human judgment mediates many normative responses, but the relational conditions from which those judgments emerge extend beyond interpersonal interaction.

6.3 Power over Classification and Commensuration

Power can enter conversion before an exchange ratio or compensation amount is determined. Classification establishes which entities are recognized, which attributes are recorded, and which differences count as relevant. Bowker and Star’s analysis of classification systems emphasizes that standards and

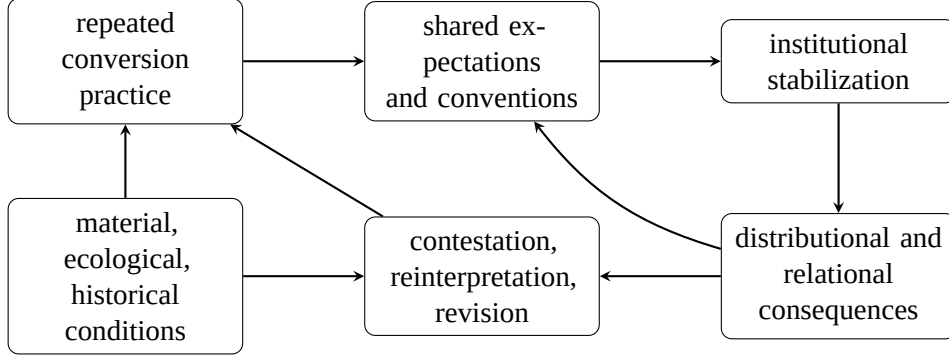


Figure 3: A schematic normogenesis cycle for heterogeneous conversion. Repeated practice can stabilize expectations and institutions, while consequences and contestation feed back into later conversion practices. Material, ecological, and historical conditions participate in the process rather than functioning as an external background.

categories participate in information infrastructures and can privilege some viewpoints while rendering others less visible [5]. For heterogeneous conversion, classification therefore shapes the domain on which commensuration subsequently operates.

Commensuration introduces another locus of power. Espeland and Stevens define commensuration as the comparison of different entities according to a common metric and explicitly analyze it as a social process with cognitive and political stakes [11]. The choice of metric can change what becomes salient, what is suppressed, and which claims can be represented in a decision procedure. A monetary amount, ranking, score, standardized unit, or legally recognized category can therefore coordinate heterogeneous information while simultaneously narrowing the range of differences that remain institutionally visible.

The present discussion distinguishes power over *classification* from power over *commensuration*. Classification determines the recognized object and its relevant attributes. Commensuration determines the common representational space through which recognized objects become comparable. The distinction is analytically useful because a conversion can be procedurally regular at the pricing stage while remaining contestable at the earlier stage where the object was defined.

This structure can be stated through two context-dependent maps. Equation 10 represents classification followed by commensuration.

$$U \xrightarrow{\mathcal{K}^{(c)}} \hat{U} \xrightarrow{\mu^{(c)}} Z^{(c)}, \quad (10)$$

where U denotes a relevant relational domain, $\hat{U}$ its institutionally recognized representation, and $Z^{(c)}$ the common comparison space used in context c . Equation 10 does not imply that either map is neutral or lossless. Epistemic and normative disagreement can concern both transformations.

6.4 Power over Conversion Interfaces

A conversion interface is the institutional location at which recognized entities, metrics, procedures, and settlement mechanisms are brought together. Control over this interface can shape who is permitted to convert, which value forms are accepted, what evidence is required, which risks are transferred, and whether the resulting settlement is reversible or contestable. Conversion power therefore includes more than bargaining strength between two visible parties.

Table 5 distinguishes several locations at which such power can operate. The categories are analytical and can overlap within one institution.

Table 5 helps distinguish several forms of centrality. An actor can possess little direct control over a price while exercising substantial authority over classification or access. Conversely, an actor can negotiate a price effectively while lacking the ability to change the settlement infrastructure or the metric under which negotiation occurs. In international monetary relations, Cohen’s analysis of currency power

Table 5: Illustrative locations of power over heterogeneous conversion interfaces.

Interface location	Structural capacity	Illustrative consequence
classification	define recognized entities and attributes	contributions or burdens become visible, aggregated, or omitted
metric design	select a common scale or comparison rule	heterogeneous differences receive unequal representational weight
access	determine standing, eligibility, or market entry	some actors can convert, claim, hedge, or contest while others cannot
pricing / valuation	influence conversion ratios or valuation procedures	benefits and losses are distributed through the conversion rule
settlement infrastructure	determine what counts as completed transfer	rights, debts, or monetary claims acquire institutional finality
revision	control reopening, appeal, or rule modification	historical errors or changed conditions become more or less correctable

provides a clear example of how differentiated monetary roles can create asymmetric capacities that extend beyond bilateral exchange-rate movements [7].

This broader view also qualifies simple contrasts between centralized and decentralized conversion. A decentralized market can still depend on highly centralized classifications, payment rails, standards, or legal recognition. A central institution can, conversely, perform a coordinating role without directly determining every substantive conversion outcome. The more precise governance question concerns which relational functions are centralized, which remain distributed, and how those arrangements affect participation, dependency, and revision.

6.5 Contestability and Revisability

Conversion nomos operates under changing conditions. New technologies can alter the objects being converted, international relations can change monetary conversion conditions, ecological constraints can change the practical meaning of compensation, and previously excluded knowledge can change how an entity is recognized. A conversion order therefore requires some account of how rules can be challenged and revised when their relational environment changes.

Contestability concerns the capacity of affected participants to raise objections to classifications, evidence, metrics, procedures, or settlements. Revisability concerns the institutional capacity to modify those structures over time. These properties are related but distinct. A process can permit objections while providing little mechanism for rule change, and an institution can periodically revise rules while giving affected parties limited standing in that revision.

Ceva’s procedural account of interactive justice is relevant here because it emphasizes fair hearing and procedural equality under persistent disagreement [6]. The present paper does not extend that theory into a general criterion of conversion justice. It uses the procedural insight more narrowly: where heterogeneous conversion remains contested, the architecture for hearing, challenging, and revising conversion terms can itself become a normatively relevant part of the conversion process.

A simple revisability condition can be represented through a family of admissible nomos states $\{\mathfrak{N}_\lambda\}_{\lambda \in \Lambda}$ and a revision relation $\rightsquigarrow_R$. Equation 11 records the possibility of structured revision.

$$\mathfrak{N}_\lambda \rightsquigarrow_R \mathfrak{N}_{\lambda'}, \quad \lambda, \lambda' \in \Lambda. \quad (11)$$

Equation 11 does not require unrestricted revisability. Legal certainty, coordination, reliance interests, and transaction costs can all provide reasons for stability. The formal point is only that a conversion order can represent revision as an institutionally structured possibility rather than as an exceptional breakdown of the system.

This distinction is especially important in a relational framework because the conversion nomos and the relations it governs can co-evolve. Conversion practices generate consequences; consequences affect

judgments and institutions; institutions reshape later conversion possibilities. A justice analysis focused only on the currently effective rule can therefore miss the distribution of power over the rule’s own reproduction and transformation. Section 7 develops the procedural dimensions of conversion justice within particular conversion histories.

7 Procedural Dimensions of Conversion Justice

This section isolates the procedural layer of heterogeneous conversion. Its role is to distinguish justice questions concerning *how* a conversion is constituted from questions concerning the resulting distribution or the substantive merits of a particular conversion ratio. The discussion focuses on five procedural loci: recognition before conversion, participation and standing, information and bargaining conditions, settlement and revision, and order sensitivity. The method is analytical and comparative. Procedural justice is treated as a family of possible evaluative concerns, with each principle occupying one part of the broader conversion-justice problem.

A useful starting point is to regard a realized conversion history as involving more than a visible transfer between two endpoints. Recognition, classification, attribution, valuation, authorization, settlement, and later review can all enter the history. A procedural evaluation therefore concerns the organization of these operations, the access of affected participants to them, and the conditions under which earlier determinations can be challenged. Table 6 summarizes the main loci developed in the section.

7.1 Recognition before Conversion

Recognition is procedurally prior to many conversion decisions because a system must identify the entity, claim, contribution, burden, or right that enters the conversion interface. The epistemic discussion in Section 4 showed that this identification can be partial and historically truncated. The procedural question is narrower: what consequences follow when conversion begins before the relevant entity or claim has been adequately recognized?

Consider a conversion history in which Φ_R denotes a recognition transformation and Φ_C a conversion transformation. Two possible orderings are stated in Equation 12.

$$H_{RC} = \Phi_C^{[\omega_R]} \circ \Phi_R^{[\omega_0]}, \quad H_{CR} = \Phi_R^{[\omega_C]} \circ \Phi_C^{[\omega_0]}, \quad (12)$$

where $\omega_R = \Phi_R(\omega_0)$ and $\omega_C = \Phi_C(\omega_0)$. Equation 12 records two distinct histories rather than two notational descriptions of one event. Recognition can alter standing, valuation inputs, available claims, or the scope of the entity subsequently converted. Conversion can likewise alter ownership, bargaining position, evidentiary access, or the possibility of later recognition.

The normative implication remains theory-relative. A procedural theory may require relevant recognition before binding conversion; another may permit provisional conversion if later review is sufficiently robust. The structural point is that a later act of recognition cannot be assumed to reconstruct the same history that would have arisen from earlier recognition. This becomes especially important when conversion creates irreversible or costly-to-reverse consequences.

Ceva’s account of interactive justice is relevant to this procedural orientation because it emphasizes fair hearing and procedural equality under persistent disagreement [6]. The present argument uses that insight at a narrower level: where recognition itself is contested, the opportunity to have a claim heard before conversion can become part of the justice of the procedure without settling the substantive value of the claim in advance.

7.2 Participation and Standing

Participation concerns the capacity to enter a conversion procedure; standing concerns whether a participant is institutionally recognized as entitled to make claims, provide evidence, object, authorize, or request review. These capacities can diverge. A person may participate informally while lacking legal

Table 6: Illustrative procedural loci in heterogeneous conversion.

Procedural locus	Primary question	Illustrative risk
recognition	what is identified and acknowledged before conversion?	later compensation is based on a truncated or misrecognized entity
standing	who can enter, speak, object, or authorize?	affected relations remain outside the procedure
information	what knowledge is available and intelligible to participants?	consent or negotiation occurs under asymmetric or inaccessible information
bargaining conditions	what alternatives, dependencies, and exit capacities structure agreement?	formally voluntary agreement reflects severe relational dependence
settlement	what counts as completed conversion?	a provisional valuation acquires premature institutional finality
revision	what can be reopened when knowledge or conditions change?	historical errors or newly visible harms remain procedurally inaccessible
ordering	in what sequence do recognition, valuation, conversion, and revision occur?	an earlier operation changes the ontology on which later operations act

standing, or possess formal standing while lacking practical access to the forum in which conversion terms are set.

The relational perspective broadens the set of potentially relevant participants. Visible contracting parties can coexist with affected workers, communities, ecological dependants, creditors, future claimants, or institutions whose rights and obligations are altered by settlement. The framework does not presume that every affected relation should receive equal standing. It makes the boundary of standing explicit as a normative design choice rather than treating the visible parties as the natural and complete set of procedural subjects.

A simple procedural profile can record this distinction. Equation 13 represents a theory-relative description of a conversion history H_C .

$$P_T(H_C) = (R_T, S_T, I_T, B_T, F_T, V_T), \quad (13)$$

where the components denote, respectively, recognition, standing, informational conditions, bargaining conditions, settlement finality, and revisability under evaluative perspective T . Equation 13 is a book-keeping device rather than a scalar justice index. A theory can treat the components differently, decline to rank them, or impose threshold requirements on only a subset.

This separation matters for conversion systems that appear participatory because negotiation occurred. Negotiation alone does not establish equal standing over classification, evidence, or revision. A worker can bargain over a wage while lacking authority to redefine the occupational category under which the wage is calculated. A community can be consulted about compensation while lacking standing to challenge the metric through which environmental loss is represented. Procedural participation therefore has several institutional locations.

7.3 Information and Bargaining Conditions

Information affects conversion procedures through more than the quantity of facts available to each party. Relevant information must be accessible, intelligible, credible, and usable within the institutional language of the conversion. Section 4 emphasized that classification and recognition can already filter the available object. Procedural analysis adds the question of how those informational conditions are distributed among participants when decisions are made.

Several asymmetries are especially relevant. One participant may understand the conversion metric while another sees only the offered outcome. One may possess historical records, legal expertise, or forecasting capacity that another cannot obtain. A platform, bank, employer, or public authority may possess

information about the conversion mechanism that individual participants cannot inspect. Fricker’s analysis of epistemic injustice provides a broader account of how credibility and interpretive resources can be distributed unequally [12]; heterogeneous conversion can translate such epistemic asymmetries into material or institutional consequences.

Bargaining conditions add another layer. Agreement can be formally voluntary while parties differ sharply in exit capacity, time pressure, liquidity, legal protection, or access to alternative conversion pathways. The present framework therefore avoids treating consent as a self-sufficient indicator of procedural justice. Consent remains normatively important in many theories, yet its significance can depend on the relational conditions under which refusal or delay is possible.

This point is especially clear in currency and labor conversion. An actor able to hold several currencies, hedge exchange risk, delay settlement, or relocate assets occupies a different bargaining position from an actor whose income, debts, and daily reproduction are tied to one currency. Similarly, a worker able to defer employment or move across labor markets faces different conversion conditions from a worker whose immediate subsistence depends on accepting the available wage. The procedural issue concerns the structure of available alternatives rather than the mere existence of a formally expressed choice.

7.4 Settlement and Revision

Settlement converts a provisional interaction into an institutionally consequential state. Payment may discharge a debt, a contract may transfer a right, compensation may close a claim, or a legal determination may establish a recognized status. The justice of conversion can therefore depend on what settlement makes difficult to reverse and on which later developments remain capable of reopening the process.

A useful distinction is between *transactional completion* and *normative closure*. Transactional completion identifies the point at which the institution treats the conversion as operationally complete. Normative closure concerns whether later evidence, altered conditions, or newly recognized relations can still generate a valid challenge. The two need not coincide. A payment can complete a transaction while a legal system preserves rights of appeal, restitution, or retrospective review.

Revisability can be represented by a revision-access relation. Let H_C denote a settled conversion history and let $\mathcal{Q}(H_C)$ denote the set of procedurally admissible review operations. Equation 14 records whether a particular review operation q remains available.

$$q \in \mathcal{Q}(H_C) \iff q \text{ is procedurally admissible after settlement of } H_C. \quad (14)$$

Equation 14 does not require unlimited reopening. Stability, reliance, administrative cost, and coordination can support finality. The formal distinction allows those reasons to be weighed explicitly against the consequences of making recognition or revision impossible after settlement.

This distinction also clarifies retrospective conversion problems. Historical contributions, environmental harms, or informational asymmetries can become visible only after an earlier settlement. A procedure with some revision capacity can respond to later recognition without claiming that the past transaction literally disappears. Within the relational framework, later revision creates a new history that refers to and transforms the present consequences of the earlier conversion.

7.5 Order Sensitivity in Conversion Procedures

Order sensitivity provides a final procedural dimension. The preliminary formalism developed for heterogeneous conversion allows operations to be state dependent: an earlier operation can change the configuration on which a later operation acts. Procedural order can therefore have substantive relational consequences even where the same named operations appear in both histories.

Figure 4 illustrates the narrow point. Recognition followed by conversion and conversion followed by recognition can reach different intermediate and final relational configurations. The diagram does not assign a justice ranking to either history.

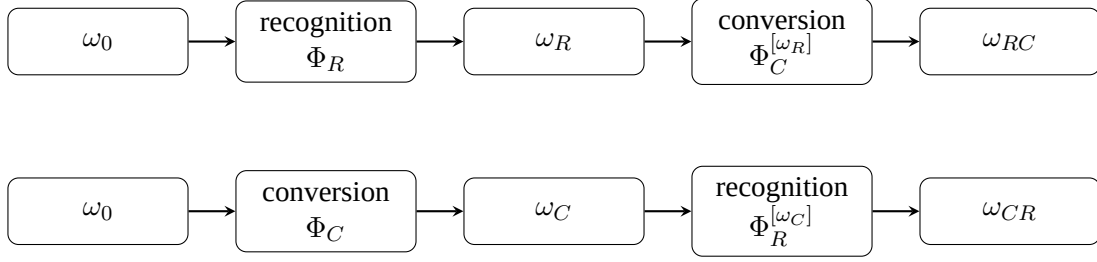


Figure 4: Order-sensitive conversion procedures. Earlier operations can change the relational configuration on which later operations act, so recognition-before-conversion and conversion-before-recognition can generate different histories without implying a predetermined normative ranking.

The formal distinction can be stated through compositional inequality when both histories are defined. Equation 15 records the general case.

$$\Phi_j^{[\omega_i]} \circ \Phi_i^{[\omega_0]} \neq \Phi_i^{[\omega_j]} \circ \Phi_j^{[\omega_0]}. \quad (15)$$

Equation 15 expresses noncommutativity under composition in a state-dependent process language. It does not yet invoke a linear operator algebra or a commutator. A stronger procedural asymmetry arises when one ordering is admissible while the reverse ordering is undefined because the first operation creates the standing, evidence, authorization, or legal status needed for the second.

This paper treats order sensitivity as one limited part of procedural conversion justice. The broader normative question remains open: different theories can assign different importance to prior recognition, consent, reversibility, finality, or later rectification. A separate discussion can therefore examine noncommutative procedural ordering in greater formal detail without requiring the entire problem of heterogeneous conversion justice to be reduced to ordering alone.

8 Distributive and Relational Consequences

The justice of heterogeneous conversion extends beyond the conditions under which a conversion is authorized or procedurally completed. A realized conversion also redistributes resources, risks, claims, dependencies, and future possibilities across the relational structures connected to it. The role of this section is to separate these downstream consequences from the procedural questions developed in Section 7. The objective is analytical rather than comprehensive: the section identifies five consequence domains that recur across heterogeneous conversions—benefits and burdens, conversion costs and risk incidence, dependency and exit capacity, future optionality, and the post-conversion relational structure—without treating any one of them as a complete theory of justice.

The central distinction is between the visible conversion outcome and the wider incidence of the conversion history. A transaction can appear balanced at the interface while producing unequal burdens elsewhere in the relational configuration. Conversely, a conversion that looks unequal in nominal terms can be embedded in institutions that redistribute risk, provide public services, or preserve future capabilities. The relevant justice question therefore depends partly on which consequences are included within the evaluative horizon. Figure 5 summarizes the architecture used in this section.

8.1 Distribution of Benefits and Burdens

A conversion creates or reallocates benefits and burdens across several relational positions. The most visible allocation is usually the pair of value forms exchanged or recognized at the interface: a wage and a period of labor, a payment and a transferred asset, a monetary award and a recognized injury, or one currency and another. The broader incidence can include taxes, fees, unpaid time, environmental

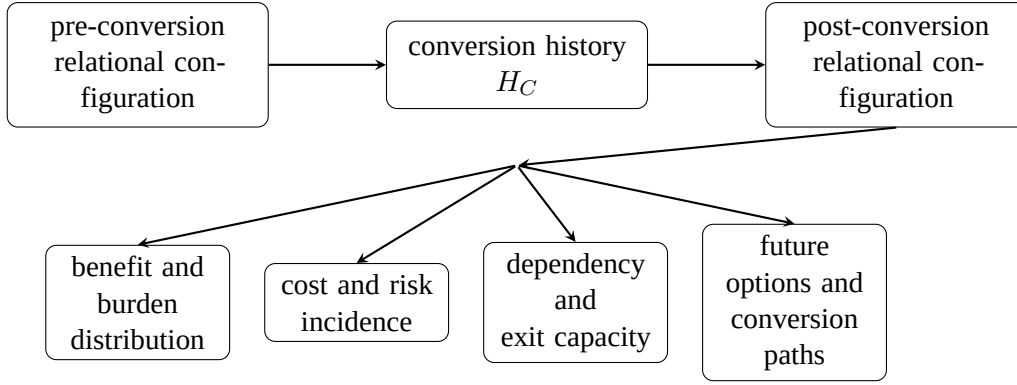


Figure 5: Conversion as a redistribution of relational conditions. A completed conversion can alter benefits and burdens, risk incidence, dependency, exit capacity, and future conversion possibilities beyond the visible transfer recorded at the conversion interface.

effects, opportunity costs, future obligations, and gains or losses borne by actors outside the immediate transaction.

For an instantiated conversion history H_C , let $\mathcal{A}_C$ denote a theory-relative set of affected relational positions. A consequence profile can then be represented by a mapping stated in Equation 16.

$$D_T : H_C \mapsto \{(a, \Delta_T(a \mid H_C)) : a \in \mathcal{A}_C\}, \quad (16)$$

where $\Delta_T(a \mid H_C)$ denotes the consequence attributed to relational position a under evaluative perspective T . Equation 16 is intentionally non-scalar. Different theories can represent consequences through income, welfare, rights, capabilities, status, ecological conditions, or other dimensions, and a theory can preserve several dimensions without converting them into one common metric.

This distinction matters because nominal equivalence can coexist with heterogeneous consequence structures. Two workers can receive the same wage while facing different housing costs, care obligations, health risks, legal protections, or access to public services. Two communities can receive the same nominal compensation for environmental loss while differing in their dependence on the affected ecosystem. The visible amount therefore supplies one part of the conversion history rather than a complete description of its distributive significance.

The capability approach provides a useful example of this broader informational basis. Sen's *Commodities and Capabilities* develops the assessment of personal advantage around what a person can do or be, rather than treating commodity possession or utility as sufficient measures of well-being [23]. The present paper does not adopt capability theory as its own substantive criterion. It uses the example to show why equal converted resources can have unequal significance when persons occupy different relational and material conditions.

8.2 Conversion Costs and Risk Incidence

Conversion normally requires more than the transfer of the headline value. Search, measurement, verification, legal compliance, brokerage, settlement, taxation, waiting, and uncertainty can all create additional costs. Some of these costs are explicit, such as a foreign-exchange spread or an administrative fee. Others are embedded in time, information requirements, exposure to price movement, or the need to maintain liquidity while a conversion remains incomplete.

The concept of incidence is useful because the actor who formally pays a cost need not be the actor who ultimately bears its relational consequence. A fee charged to one party can be passed through to another through prices or wages. Exchange-rate risk can be shifted through contract denomination. Environmental costs can be externalized to people who were absent from the original conversion. A compensation arrangement can transfer immediate monetary resources while leaving long-duration risk with the affected party.

Let r denote a conversion-related risk source and $\mathcal{A}_C$ the affected relational positions. A risk-incidence profile is represented in Equation 17.

$$R_T(H_C, r) = (\rho_T(a_1 \mid r, H_C), \dots, \rho_T(a_m \mid r, H_C)), \quad (17)$$

where ρ_T records the exposure attributed to each position under perspective T . Equation 17 does not require exposures to be cardinally measurable or additive. Its purpose is to prevent risk from disappearing merely because the nominal conversion ratio has been specified.

International monetary conversion supplies a clear illustration. An actor with access to several currencies, derivative markets, liquid reserves, or geographically diversified assets can redistribute exchange-rate risk more readily than an actor whose income, debt, and daily expenditures are concentrated in one currency. Section 5 described currency hierarchy as a differentiated structure of international usability. The present subsection adds that the same hierarchy can affect who is able to transfer, hedge, or absorb conversion risk. The resulting incidence is therefore a relational property of the conversion system as well as a property of the quoted exchange rate.

8.3 Dependency and Exit Capacity

Conversion can alter dependency by changing which relations a participant must maintain in order to obtain income, settlement, recognition, or access to future exchanges. A participant with several viable conversion pathways can refuse one transaction while preserving other possibilities. A participant whose livelihood or legal status depends on one conversion interface can face substantially narrower alternatives even when formal consent is present.

Hirschman's distinction between *exit* and *voice* provides a useful vocabulary for this issue. Exit refers to leaving an organization or switching away from a deteriorating relationship, while voice refers to attempts to change conditions from within [13]. The distinction is broader than heterogeneous conversion, yet it highlights a feature directly relevant here: a conversion order can distribute the practical capacity to refuse, leave, substitute, or contest very unevenly.

For a participant a in configuration ω , let $\mathcal{X}(a \mid \omega)$ denote the set of conversion pathways that the model treats as practically available to that participant. Equation 18 defines a minimal exit-set representation.

$$\mathcal{X}(a \mid \omega) = \{\Gamma \in \text{Hist}(\omega) : \Gamma \text{ provides an admissible alternative conversion path for } a\}. \quad (18)$$

Equation 18 is a compact set-valued representation of a theory-dependent notion of practical availability. An alternative can exist legally while remaining inaccessible because of liquidity constraints, migration restrictions, missing information, time pressure, or the absence of substitute institutions.

Dependency can therefore increase even when immediate material benefits rise. A platform can pay a higher rate while making workers more dependent on one ranking or payment infrastructure. A creditor can provide liquidity while increasing a debtor's exposure to one currency or jurisdiction. A state can obtain cheaper financing while deepening reliance on an external settlement network. These cases do not establish injustice by themselves. They show that post-conversion dependency is an evaluative dimension that can diverge from the visible transfer.

8.4 Convertibility and Future Optionality

Future optionality concerns the set of materially and institutionally available continuations after conversion. The concept differs from exit capacity because exit focuses on leaving or substituting a current relation, while optionality includes broader possibilities such as saving, investing, learning, moving across value forms, delaying later conversion, entering new institutions, or preserving a position until more information becomes available.

The relational significance of a converted value therefore depends partly on its subsequent convertibility. A monetary payment that can be held, transferred across currencies, invested, or used as collateral

has a different future-option structure from a payment that must be consumed immediately or cannot be moved across institutional boundaries. Likewise, a credential recognized across several jurisdictions creates different future conversion possibilities from an otherwise similar credential whose recognition is institutionally local.

Sen’s capability framework again offers a useful comparison because it directs attention from resources alone toward the substantive opportunities those resources make feasible [23]. The present concept of optionality is not intended as a replacement for capabilities. It is narrower and conversion-specific: it asks which later transformations remain available after a particular conversion history.

Let $\text{Ext}(\omega^+; a)$ denote the admissible continuation histories available to participant a from the post-conversion configuration ω^+ . Equation 19 defines the corresponding option set.

$$\mathcal{O}_C(a) = \text{Ext}(\omega^+; a). \quad (19)$$

Equation 19 allows a theory of justice to compare post-conversion possibility structures without assuming that more options are always better. Some options can be harmful, meaningless, or available only through unacceptable costs. The formalism merely makes the change in accessible continuations visible for later normative evaluation.

8.5 Conversion and Subsequent Relational Structure

The broadest consequence of heterogeneous conversion is that it can change the relational configuration from which later conversions, judgments, and institutions emerge. A labor contract can generate authority relations and future expectations. A currency conversion can alter balance sheets and exposures. A compensation settlement can close some claims while creating others. Recognition of knowledge or status can modify institutional standing. Conversion therefore participates in producing the environment of subsequent conversion rather than merely moving value through an otherwise unchanged system.

This recursive effect can be summarized through the transition in Equation 20.

$$H_C : \omega^- \mapsto \omega^+, \quad \omega^+ \in \Omega(H_C), \quad (20)$$

where ω^- and ω^+ denote the modeled pre- and post-conversion configurations. Equation 20 emphasizes that the post-conversion configuration is itself part of the conversion’s significance. It can contain new rights, debts, dependencies, institutional precedents, recognized categories, or altered conversion pathways.

Table 7 summarizes the five consequence domains developed in the section. The table also indicates why each domain can vary independently of the nominal conversion ratio.

Table 7 clarifies the section’s principal claim: conversion justice can concern the distribution of relational consequences as well as the distribution of converted values. The framework leaves priority among these consequences to substantive normative argument and provides a common description on which different theories can operate. Section 9 compares the informational and evaluative commitments through which several normative traditions can interpret the same conversion history.

Table 7: Distributive and relational consequence domains of heterogeneous conversion.

Consequence domain	Analytical focus	Illustrative divergence from the visible ratio
benefits and burdens	who gains, loses, or bears collateral consequences	equal payment can coexist with unequal living costs, obligations, or ecological dependence
risk incidence	who ultimately absorbs uncertainty and conversion-related loss	identical exchange terms can place currency, price, or legal risk on different participants
dependency and exit	ability to refuse, leave, substitute, or contest a conversion relation	formally voluntary conversion can occur under sharply unequal alternative pathways
future optionality	post-conversion set of feasible continuations	equal resources can support different capacities to save, invest, migrate, learn, or reconvert
relational reproduction	how conversion changes later rights, obligations, institutions, and conversion pathways	the same immediate transfer can create different long-run structures of dependence or standing

9 Normative Perspectives on Conversion

This section situates heterogeneous conversion within several established normative traditions. Its role is comparative rather than adjudicative. The objective is to show that a single conversion history can become normatively salient in different ways depending on the informational basis, unit of assessment, procedural commitments, and evaluative relations adopted by a theory. The discussion therefore treats welfare, entitlement, institutional fairness, capabilities, exploitation, relational equality, procedural justice, epistemic justice, and value pluralism as partially overlapping perspectives rather than as interchangeable formulations of one underlying criterion.

Table 8 summarizes the different questions emphasized by the perspectives considered below. The table is intentionally schematic. Each tradition contains internal disagreements, and several theories combine considerations that the table separates for analytical clarity.

9.1 Welfare and Consequential Evaluation

Consequential approaches evaluate acts, practices, or institutions by reference to the goodness of their consequences. Utilitarian traditions are the historically most familiar example and typically organize evaluation around aggregate welfare, although consequentialist theories differ substantially over what counts as welfare, whose consequences matter, and whether evaluation is attached directly to acts or mediated through rules [14].

Applied to heterogeneous conversion, this perspective directs attention from the nominal ratio toward the consequences generated by the conversion history. A wage conversion can be evaluated through changes in well-being, security, consumption, health, or future opportunity. A currency conversion can be evaluated through effects on purchasing capacity, balance-sheet exposure, inflation risk, or macroeconomic stability. Environmental compensation can be evaluated through consequences for affected communities and ecological systems. Section 8 developed several of these downstream domains without assigning them one common welfare metric.

The consequential perspective is therefore naturally compatible with a history-based representation because the conversion object extends beyond the immediate transfer. Its limitations arise from the informational basis selected for aggregation. A welfare measure can represent distributional effects if distribution enters the evaluative function, yet an aggregate outcome can also leave procedural standing, entitlement, domination, recognition, or non-compensable losses underdescribed. The present framework therefore treats welfare evaluation as one theory-relative reading of the conversion history rather

Table 8: Illustrative normative perspectives on heterogeneous conversion.

Perspective	Primary evaluative focus	Conversion question made salient	Residual issue
welfare / consequential	effects on welfare or other valued consequences	what consequences the conversion produces and for whom	aggregation can obscure distribution, rights, status, or procedure
entitlement / transfer	historical legitimacy of acquisition and transfer	whether holdings and transfers arise through justice-preserving processes	background entitlement and rectification remain prior questions
Rawlsian institutional	fairness of the institutional basic structure	how conversion rules affect liberties, opportunities, and advantaged or disadvantaged positions	local bilateral consent may be insufficient for institutional assessment
capability-oriented	substantive opportunities to do and be	what converted resources enable participants to achieve in practice	capability selection and comparison require further normative specification
exploitation	unfair advantage and productive or structural relations	whether one party or structure benefits unfairly from another's vulnerability or contribution	theories disagree about the relevant baseline and source of unfairness
relational equality / non-domination	social status, dependence, and arbitrary power	whether conversion creates inferior status or subjection to uncontrolled power	material distribution remains relevant but is not the sole object
procedural justice	standing, hearing, interaction, and revision	how recognition, participation, information, settlement, and contestation are organized	fair procedure does not by itself settle every substantive outcome
epistemic justice	credibility, interpretive resources, and recognition	whose knowledge and categories shape the conversion object and evidence	epistemic repair does not by itself determine a fair conversion ratio
value pluralism / incommensurability	limits of common measurement and ranking	whether the relevant values should be fully commensurated at all	practical decisions can remain necessary under incomplete comparison

than as the default interpretation of all conversion consequences.

9.2 Entitlement and Voluntary Transfer

Entitlement-oriented approaches shift attention from patterned end states toward the history through which holdings and transfers arise. Nozick's entitlement theory distinguishes justice in acquisition, justice in transfer, and rectification of prior injustice; on this view, the legitimacy of a holding depends on the history that produced it rather than on whether the resulting distribution conforms to an independently specified pattern [17].

This historical emphasis has a direct interface with heterogeneous conversion. A conversion that appears voluntary at the moment of exchange can still depend on contested prior holdings, earlier coercive transfers, or unresolved claims. Conversely, a highly unequal post-conversion distribution need not be condemned by an entitlement theory solely because of its pattern if the relevant acquisition and transfer history is judged legitimate. The conversion history therefore has to include the provenance of the rights being converted when an entitlement perspective is applied.

Voluntary transfer is also narrower than complete conversion justice. Consent to a wage, sale, or currency exchange can be normatively important while leaving open questions about background ownership, fraud, informational asymmetry, practical exit, or rectification. The framework developed in Sections 4–8 can make these background relations visible without deciding which of them an entitlement theory should treat as dispositive.

9.3 Rawlsian Institutional Justice

Rawls’s account of justice as fairness evaluates the basic structure of society through principles governing equal basic liberties, fair equality of opportunity, and the distribution of social and economic advantages, including the difference principle for inequalities within the relevant institutional scheme [21]. The central object is therefore not a sequence of isolated bilateral transactions. It is the institutional structure that assigns rights, duties, opportunities, and distributive positions over time.

For heterogeneous conversion, a Rawlsian perspective can ask whether conversion interfaces belong to, or are shaped by, institutions that structure citizens’ life prospects. Labor markets, educational credentials, access to credit, monetary institutions, property rules, taxation, and legally recognized compensation mechanisms can all affect the distribution of primary goods and opportunity. A conversion ratio that appears acceptable in one transaction can therefore receive a different assessment when examined as part of an institutional pattern that systematically structures advantage.

The GR discussion does not attempt to derive Rawlsian principles from relational emergence. It uses the conversion history to supply a richer description of the institutional processes to which Rawlsian principles could be applied. The normative authority of those principles remains part of Rawls’s theory rather than a consequence of the formalism itself.

9.4 Capability-Oriented Evaluation

The capability approach shifts evaluation from resources alone toward the substantive opportunities people have to achieve valuable beings and doings. Sen’s formulation emphasizes that equal commodity bundles can support unequal capabilities because personal, social, and environmental conditions mediate what people can actually achieve with them [23]. Contemporary capability literature commonly describes these mediating conditions as conversion factors [22].

The word *conversion* therefore carries two related but distinct meanings in this paper and in the capability literature. Heterogeneous value conversion concerns transformation or comparison across value forms, while capability conversion factors concern the conditions under which resources become substantive opportunities or functionings. The distinction is analytically useful because the first process can feed directly into the second. Two participants can receive the same monetary amount through a conversion while acquiring different substantive opportunities because housing costs, disability, care obligations, legal status, public services, or environmental conditions differ.

A capability-oriented evaluation of a conversion history can therefore examine the post-conversion opportunity structure rather than treating the transferred resource as the final evaluative object. This perspective connects naturally with the future-option discussion in Section 8.4, while remaining normatively richer than a simple count of available options. The capability approach still requires further specification concerning which capabilities matter, how they should be compared, and what distributive principles apply.

9.5 Exploitation and Productive Relations

Exploitation theories bring productive relations, vulnerability, appropriation, and unfair advantage into the analysis of conversion. Marx’s analysis of capitalist production located exploitation within the relation between labor power, production, and surplus appropriation [15]. Contemporary philosophical discussions are broader: exploitation can be analyzed as transactional or structural, harmful or mutually beneficial, and theories disagree over the baseline that makes advantage-taking unfair [24].

For heterogeneous conversion, exploitation analysis is especially relevant when a visible exchange conceals the productive history through which the converted value became available. A wage transaction, for example, can be formally voluntary while a theory of exploitation focuses on ownership of productive assets, bargaining vulnerability, appropriation of surplus, or the structure of available alternatives. The same logic can extend beyond labor when one party controls a conversion interface through which another party's contribution, data, knowledge, ecological dependence, or vulnerability becomes monetizable.

The present framework leaves open whether a particular theory of exploitation relies on a labor theory of value and whether a given asymmetric conversion counts as exploitative. It provides a history in which competing exploitation theories can identify different sources of advantage, vulnerability, appropriation, and structural dependence. This is particularly important because contemporary exploitation theory contains substantive disagreement over whether unfairness lies in outcomes, processes, background institutions, interpersonal attitudes, or combinations of these elements.

9.6 Relational Equality and Non-Domination

Relational egalitarian approaches evaluate the social relations through which people stand to one another, rather than treating equality exclusively as a pattern of distributed goods. Anderson's influential formulation emphasizes equality of social standing and rejects relations in which some people are socially positioned as inferiors [1]. Republican theories of freedom add a related concern with domination: Pettit's account understands freedom as non-domination, meaning freedom from subjection to arbitrary or uncontrolled power even when that power is not continuously exercised [20].

These perspectives make several conversion features salient that a ratio or aggregate welfare measure may leave obscure. A worker can receive a relatively high wage while remaining subject to one-sided discretionary control. A borrower can obtain beneficial credit while becoming dependent on a creditor able to alter essential conditions. A community can receive compensation while losing standing over the future use of a resource. In each case, the conversion can improve material holdings while also changing social status, dependency, or exposure to uncontrolled power.

The distinction is therefore relational rather than anti-distributive. Material inequality can contribute to domination, and distributive resources can support equal standing. The analytical gain lies in making the relation itself an object of evaluation. Section 8.3 already represented exit capacity and dependency as post-conversion consequences; relational equality and non-domination supply theories under which those consequences can acquire normative significance.

9.7 Procedural Justice

Procedural approaches ask how decisions and interactions are organized as well as what outcomes they produce. Ceva's proceduralist account of interactive justice, developed for persistent value conflict, emphasizes fair hearing and procedural equality among parties who remain in disagreement [6]. The domain differs from heterogeneous conversion, but the procedural insight is directly useful: disagreement over substantive value does not eliminate the possibility of evaluating the terms under which participants interact.

Section 7 translated this insight into conversion-specific loci such as recognition, standing, information, bargaining, settlement, and revision. A procedural theory can therefore evaluate whether participants had meaningful opportunities to make claims, challenge classifications, contest evidence, or reopen a settlement. It can also evaluate ordering when recognition, valuation, conversion, and settlement are sequentially dependent.

The present paper treats procedural justice as one layer rather than a complete conversion criterion. A procedurally fair exchange can still generate distributive, relational, epistemic, or ecological objections under other theories. Conversely, a procedure criticized under one procedural standard can generate consequences that another theory values highly. The framework preserves these possible divergences for explicit comparison.

9.8 Epistemic Justice

Epistemic justice concerns wrongs connected to people in their capacities as knowers. Fricker's account distinguishes testimonial injustice, involving credibility deficits linked to identity prejudice, from hermeneutical injustice, involving structural gaps in collective interpretive resources [12]. Heterogeneous conversion creates a natural interface with these concerns because conversion depends on identifying entities, recognizing claims, classifying contributions, and determining what evidence can enter a valuation procedure.

The epistemic question can arise before a substantive conversion ratio is considered. If an institution does not recognize a form of care, tacit knowledge, historical contribution, ecological dependence, or culturally specific meaning, the omitted relation may never enter the conversion procedure. If one participant's testimony receives systematically less credibility, information relevant to risk or harm can be discounted before settlement. Section 4 therefore treated epistemic architecture as constitutive of the conversion object rather than as an external correction applied after valuation.

An epistemic-justice perspective nevertheless does not specify a complete fair conversion. Correcting credibility or interpretive exclusion can improve the informational basis while leaving distributive, procedural, entitlement, or capability questions unresolved. Its role in the integrative framework is to make the justice of recognition and knowledge production explicit.

9.9 Value Pluralism and Limits of Commensuration

Value pluralism and incommensurability place pressure on the assumption that every heterogeneous conversion can be justified by locating a complete common measure. Philosophical treatments of incommensurable values distinguish several forms of comparison failure, including cases in which cardinal measurement is unavailable and stronger cases in which even ordinary better-than, worse-than, or equality relations fail to settle the comparison [2]. The literature also emphasizes that comparability can depend on the covering consideration under which two alternatives are compared.

For heterogeneous conversion, this perspective supports a distinction between practical commensuration and exhaustive normative equivalence. Institutions may need a common denominator for taxation, compensation, budgeting, adjudication, or exchange even when the relevant values are not fully reducible to that denominator. A monetary award can settle a legal claim without establishing that money exhausts the value of the loss. A cost-benefit comparison can support one decision procedure without proving that all relevant values belong to a single cardinal scale.

The resulting normative implication is cautious. Partial commensurability can justify some comparisons while leaving residual dimensions outside the conversion interface. A theory that recognizes such residuals may require lexical constraints, separate thresholds, side conditions, qualitative deliberation, or explicit acknowledgment of unresolved value. The formal language therefore permits incomplete ordering and plural evaluative dimensions rather than treating a scalar conversion ratio as the necessary endpoint of every justice analysis.

Taken together, the perspectives in Table 8 show that conversion justice is underdetermined by the conversion ratio itself. The same history can be interpreted through welfare consequences, provenance of entitlement, institutional fairness, capabilities, exploitation, social relations, procedure, epistemic recognition, or the limits of commensuration. Section 10 uses the Generative Relational framework to place these normative readings in a common descriptive architecture while preserving their substantive disagreements.

10 Generative Relational Integration of Conversion Justice

The normative perspectives reviewed in Section 9 differ in their objects of concern, informational bases, and standards of assessment. The role of the present section is to specify how the Generative Relational (GR) framework can place these perspectives in a shared descriptive architecture without converting

them into one substantive theory of justice. The objective is integrative rather than adjudicative. A common conversion history is retained as the descriptive object; each normative theory then identifies the entities and relations it treats as salient, evaluates those identified features within its own evaluative space, and can generate judgments that subsequently participate in relational evolution. This architecture supports comparison across theories while preserving disagreement concerning what justice requires.

The resulting structure is summarized in Figure 6. A shared conversion history H_C provides the common descriptive base. A theory T applies a theory-relative identification map $\mathcal{I}_T$, followed by an evaluation map $\mathcal{E}_T$. The evaluative result can contribute to a judgment process whose institutional or practical expression changes the subsequent relational configuration. The arrows in the figure indicate analytical dependence rather than a claim that normative reasoning always follows a single linear sequence.

10.1 Shared Relational Histories across Normative Theories

The first integrative commitment is descriptive: different normative theories can be applied to the same modeled conversion history without requiring agreement about its normative significance. Let $\mathcal{H}_C$ denote the class of instantiated conversion histories admitted by the discussion, and let Equation 21 state the minimal common object.

$$H_C \in \mathcal{H}_C. \quad (21)$$

Equation 21 fixes only the shared object of analysis. The history can contain pre-conversion relations, entity-identification procedures, claims, classifications, transfers, settlements, risks, institutional responses, and post-conversion consequences. Its representation can remain coarse where detailed formal reconstruction is unnecessary. The point is to keep one traceable process available for several normative readings.

A shared history does not imply a shared metric. A consequentialist can attend to welfare consequences within H_C ; an entitlement theory can emphasize acquisition and transfer; a capability approach can examine substantive opportunities; an exploitation analysis can reconstruct productive relations and vulnerability; procedural justice can examine participation and review; epistemic justice can examine recognition, credibility, and interpretive resources. These theories can therefore refer to overlapping events without treating those events as normatively equivalent.

This distinction is important for heterogeneous conversion because disagreements often arise before any final evaluative comparison is attempted. Two theories can agree that a wage was paid, that a settlement occurred, that one party lacked a viable exit route, and that a form of care work was omitted from the institutional record while assigning different normative significance to those facts. GR integration begins from this possibility of descriptive overlap under normative plurality.

The shared-history strategy also limits a common failure of synthetic frameworks: translating several theories into one vocabulary can accidentally convert translation into assimilation. The present discussion treats the relational history as a common descriptive interface. It does not treat that interface as evidence that the theories share one conception of value, one ordering of social states, or one account of moral reasons.

10.2 Theory-Relative Entity Identification

Normative theories differ partly because they identify different entities, relations, and historical intervals as relevant to evaluation. Section 4 introduced entity identification as a constitutive part of conversion. The same issue reappears at the normative level. A theory can evaluate only the entities and relations made available within its evaluative description, and different theories can construct different evaluative objects from the same conversion history.

Let $\mathfrak{E}_T$ denote the space of relational objects recognized as evaluatively relevant under theory T . A theory-relative identification map is stated in Equation 22.

$$\mathcal{I}_T : \mathcal{H}_C \longrightarrow \mathfrak{E}_T, \quad \Xi_T(H_C) = \mathcal{I}_T(H_C). \quad (22)$$

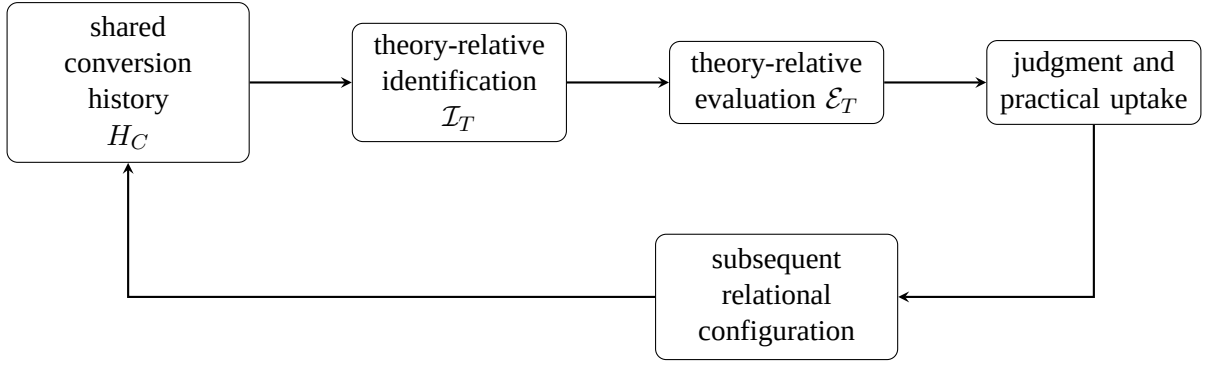


Figure 6: Integrative use of the GR framework across normative theories. The same modeled conversion history can be identified and evaluated differently under different theories. Judgment and practical uptake can then become part of subsequent relational evolution, which supplies the historical context for later conversions and evaluations.

In Equation 22, $\Xi_T(H_C)$ is the relational material selected for evaluation under T . The codomain is theory-relative because a Rawlsian analysis, a capability analysis, an exploitation analysis, and an epistemic-justice analysis need not identify the same unit of concern.

A Rawlsian analysis can foreground institutional positions and the distribution of primary goods within the basic structure. A capability-oriented analysis can identify persons together with the material and social conversion factors that shape substantive opportunities. Exploitation theories can extend the relevant object to productive relations, ownership, vulnerability, and appropriation. Procedural approaches can identify participants, claims, standing, informational conditions, and opportunities for contestation. Epistemic justice can identify knowers, credibility relations, classificatory resources, and institutional practices of recognition. These examples show that the “entity” of normative evaluation is often a relational configuration rather than an isolated person or object.

Theory-relative identification does not imply unrestricted interpretive freedom. The identified object remains constrained by the modeled history, available evidence, and the theory’s own explicit commitments. An attribution that invents events absent from the history or suppresses contrary evidence cannot be defended merely by labeling it theory-relative. The distinction is between legitimate differences in evaluative focus and failures of representation. Section 4 supplies the epistemic vocabulary for examining that boundary.

The same identification problem can arise within one theory. Historical depth, scale, and institutional context can change which relations are visible. A capability analysis can differ depending on whether housing, care obligations, migration status, or public services enter the conversion factors under study. An exploitation analysis can differ depending on whether it treats a transaction as locally bilateral or embeds it within longer productive and property relations. GR therefore treats entity identification as an explicit analytical operation rather than a hidden preliminary assumption.

10.3 Theory-Relative Evaluation

After theory-relative identification, a normative theory evaluates the history and the identified relational material according to its own standards. The evaluative output need not be a scalar score. It can be a vector of considerations, a partial ordering, a set of rights or constraints, a threshold condition, a qualitative judgment, or another structured evaluative object. The GR framework therefore requires only a typed evaluative map, not a universal numerical metric.

Let E_T denote the evaluative space associated with theory T . Equation 23 represents the evaluative step.

$$\mathcal{E}_T : \mathcal{H}_C \times \mathfrak{E}_T \longrightarrow E_T, \quad e_T(H_C) = \mathcal{E}_T(H_C, \Xi_T(H_C)). \quad (23)$$

Equation 23 separates the shared history from the theory-relative evaluative space. This separation allows

theories to preserve their own informational bases. A capability evaluation need not be translated into utility, a rights-based constraint need not be converted into a welfare weight, and an epistemic-justice assessment need not be reduced to distributive income effects.

The structure also permits incomplete comparison. Some theories can rank two histories only under specified conditions, while others can identify several independently important dimensions without defining a complete ordering among them. Value-pluralist approaches can deliberately preserve residual incommensurability. In such cases, E_T can contain a partial relation or structured set rather than a single ordered scale.

Cross-theory comparison therefore concerns the architecture of evaluation more often than the direct comparison of evaluative outputs. The paper can ask which entities each theory identifies, which historical intervals it examines, which conversion consequences it treats as salient, and which forms of justification it accepts. These comparisons clarify disagreement without requiring a common “justice unit” into which every theory must be converted.

This point is especially important for a paper on heterogeneous value. A framework designed to study the risks of forced commensuration would be internally inconsistent if it forced heterogeneous normative theories into one metric merely for the convenience of synthesis. GR integration is therefore structural: it coordinates several evaluative languages around a common history while permitting their evaluative codomains to remain heterogeneous.

10.4 Normative Judgment and Relational Evolution

Normative evaluation can remain an analytical exercise, or it can enter practice through judgment, policy, institutional decision, collective action, or altered expectations. Once expressed and acted upon, normative judgment becomes part of the relational history it evaluates. A court judgment can modify rights and standing; a professional norm can alter recognition practices; a political judgment can redirect resources; a social movement can change available categories of claim. The integrative language therefore treats practical judgment as potentially generative rather than as an external label placed on an otherwise unchanged world.

A light representation is sufficient for the present paper. Let ω denote the current modeled relational configuration and let $e_T(H_C)$ be the evaluative result from Equation 23. A judgment-generation map can produce a state-changing transformation as represented in Equation 24.

$$\mathcal{J}_T(\omega, e_T(H_C)) = \Phi_{J,T}^{[\omega, e_T]}, \quad \Phi_{J,T}^{[\omega, e_T]} : \Omega \rightarrow \Omega. \quad (24)$$

Equation 24 does not imply that every moral judgment directly changes institutions or that a theory determines a unique action. It records the possibility that an evaluative judgment, once instantiated in a subject or institution with relevant capacities, can generate transformations in the relational configuration.

This formulation also clarifies why normative judgment need not be modeled as a binary output. A judgment can alter priorities, admissible operations, burdens of proof, institutional attention, or the relative support given to several possible continuations. Its practical expression can therefore reshape the field of subsequent action without specifying one deterministic future. The subsequent analysis of emergent normativity develops this reflexive structure in greater depth.

The generative role of judgment does not make normativity self-validating. A judgment can stabilize an unjust institution, reinforce a mistaken classification, or amplify an epistemically distorted understanding. The fact that normative language participates in relational evolution is descriptive. Its justification remains theory-relative and contestable. This distinction preserves the separation between explaining how norms become effective and defending their normative authority.

10.5 Irreducible Normative Disagreement

The integrative architecture is complete only if it preserves the possibility that normative disagreement remains unresolved after the descriptive history has been clarified. Several kinds of disagreement can

persist. Theories can disagree over the identity of the relevant entity, over the evaluative dimension that matters, over the priority among several dimensions, over the baseline against which a conversion is assessed, or over whether certain values should be converted at all. Table 9 summarizes these locations of disagreement.

The disagreements in Table 9 cannot be resolved merely by adding more detail to the GR representation. Better description can reveal that a dispute previously attributed to one issue actually concerns another. It can show, for example, that two theories agree on the distributional consequences but disagree on entitlement, or that an apparent dispute over price is partly a dispute over which entity should be recognized. Clarification can therefore improve normative argument without guaranteeing convergence.

The framework preserves a distinction between pluralism and indifference. A theory can make strong substantive judgments within its own evaluative commitments, and institutions can adopt particular normative standards. GR integration concerns the level at which those commitments are represented and compared. It does not require a neutral political or moral stance from every practical decision-maker, and it does not transform all disagreements into equally supported alternatives.

The resulting position is one of pluralistic integration. Heterogeneous normative theories can share a relational history, expose their identification and evaluative assumptions, and trace the consequences of judgments while retaining disagreements that arise from genuinely different normative commitments. Section 11 extends this architecture to emergent normativity by treating normative judgments and stabilized nomos as historically situated parts of relational evolution.

Table 9: Locations of irreducible normative disagreement within a shared conversion history.

Location	Typical form of disagreement
entity identification	which persons, relations, institutions, or historical intervals constitute the normatively relevant conversion object
evaluative dimension	whether the salient concern is material gain, capability, entitlement, exploitation, domination, recognition, procedure, or another dimension
baseline	whether loss, advantage, or unfairness is assessed against prior holdings, feasible alternatives, fair institutions, or another reference point
priority structure	how several recognized values are ordered, constrained, or given lexical priority when they point toward different assessments
commensurability	whether the relevant values admit a common ordering or metric, and whether monetary or other settlement leaves residual value outside the conversion interface
justificatory source	whether normative authority is grounded in consequences, rights, fair procedure, equal relations, public justification, or another basis

11 Emergent Normativity

Section 10 treated normative theories as theory-relative evaluative structures applied to a shared conversion history. The present section develops the complementary dynamic question: how normative judgment, once articulated and practically instantiated, can become part of the relational history that later evaluations inherit. The objective is descriptive and integrative. The section distinguishes evaluative judgment from the conditions of its emergence, represents practical judgment as a relational event that can generate state-changing operations, and situates normative evolution within historical, institutional, technological, ecological, and material conditions. Historical emergence is kept distinct from normative authority. The analysis specifies how judgments and nomos can become dynamically effective while their justification remains open to the normative perspectives reviewed in Section 9.

The resulting architecture is summarized in Figure 7. A modeled relational configuration supplies the historical and material context in which a theory-relative evaluation is formed. Practical judgment can then generate a transformation that modifies the subsequent configuration. The effective nomos of that later configuration becomes part of the conditions under which later conversions and judgments occur. Environmental, technological, and institutional conditions enter through the configuration itself rather than as an external list of human preferences.

11.1 Relational Event Structure of Normative Judgment

Normative judgment is often represented as a proposition about an already constituted object: a conversion is described as fair, unfair, permissible, exploitative, or otherwise normatively characterized. Such propositions remain useful, yet practical judgment can have a second role. Once a judgment is expressed by a person, court, organization, professional body, political movement, or other capable subject, the expression can itself become an event in the relational history. It can create claims, redirect attention, alter standing, authorize review, modify expectations, or support new institutional actions. The judgment therefore has both semantic content and possible relational consequences.

The present framework represents this distinction by retaining the evaluative output $e_T(H_C)$ from Equation 23 and treating practical uptake through the judgment-generation map introduced in Equation 24. When the resulting transformation is defined for the current configuration, Equation 25 gives the corresponding update.

$$\omega_{\Sigma'} = \Phi_{J,T}^{[\omega_{\Sigma}, e_T]}(\omega_{\Sigma}). \quad (25)$$

Equation 25 represents a judgment that has acquired practical efficacy. The equation does not require a binary evaluative output. The evaluative space E_T can contain a partial ordering, a structured set of considerations, a threshold relation, or another theory-specific object. The resulting transformation can likewise alter several dimensions of the configuration without selecting a unique deterministic continuation.

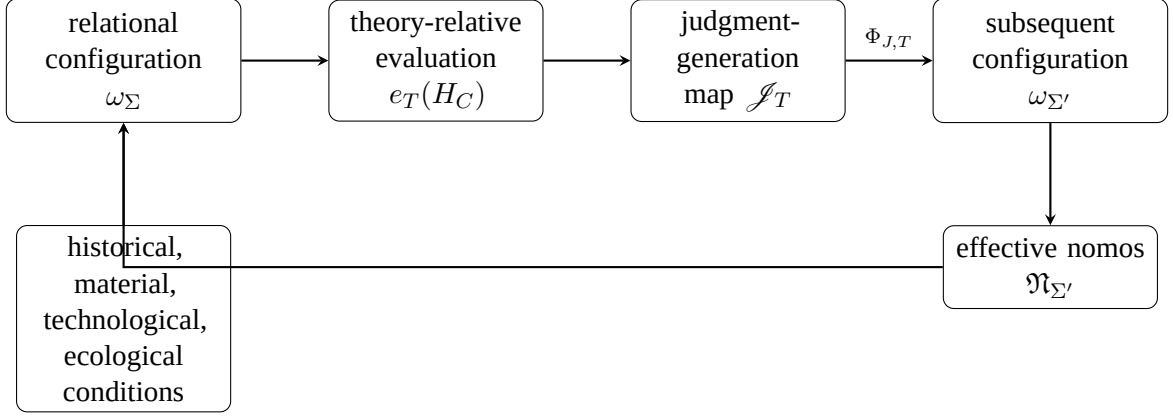


Figure 7: Reflexive structure of emergent normativity. Historical, material, technological, ecological, and institutional conditions enter the modeled relational configuration. Theory-relative evaluation can generate a practical judgment transformation, whose consequences alter the subsequent configuration and its effective nomos. The cycle represents historical dependence rather than normative self-validation.

A judgment event also need not be reducible to an isolated individual decision. Institutional judgments can be distributed across procedures, records, professional routines, voting rules, or algorithmically mediated systems. Relational sociology provides a useful background for treating entities and actions as embedded in dynamic relational processes rather than as self-sufficient substances [10]. The present framework extends that process orientation to normative uptake: the practical meaning of a judgment depends on the relations through which it becomes effective.

This representation preserves a distinction between judgment and justification. A discriminatory classification, an exploitative contract norm, or an epistemically distorted assessment can become institutionally effective and therefore generate a transformation in Equation 25. Its practical efficacy does not establish its normative legitimacy. Emergence explains how a judgment can enter subsequent history; normative theories supply the standards by which that judgment and its consequences can be assessed.

11.2 Judgment-Induced Evolution

The generative effect of judgment can be understood more broadly than direct command. A judgment can change which actions receive institutional support, which claims become intelligible, which burdens of proof apply, which risks are treated as salient, or which conversion paths remain practically available. In these cases, judgment changes the structure of subsequent possibility rather than specifying a single future state.

Let $\mathcal{A}(\omega_\Sigma)$ denote the family of modeled operations available from configuration ω_Σ . A practical judgment can alter this family by enabling, disabling, or modifying subsequent operations. Equation 26 states the corresponding schematic map.

$$\mathcal{D}_{J,T}^{[\omega_\Sigma]} : \mathcal{A}(\omega_\Sigma) \longrightarrow \mathcal{A}(\omega_{\Sigma'}). \quad (26)$$

Equation 26 is deliberately general. A court judgment can make a restitution procedure available; recognition of a contributor can enable an attribution claim; a regulatory judgment can restrict a settlement mechanism; a changed professional standard can modify which evidence is admissible. The transformation of available operations can therefore be one mechanism through which normativity acquires practical force.

An optional history-weight representation can be introduced when a model contains several admissible continuations and assigns them nonnegative transition weights. If $W_\Sigma(H)$ denotes a model-specific weight assigned to candidate continuation H , judgment can induce a deformation $\mathcal{D}_{J,T}$ as stated in Equation 27.

$$W_{\Sigma'}^{(J,T)}(H) = \mathcal{D}_{J,T}[W_\Sigma](H). \quad (27)$$

Equation 27 is a modeling option rather than a commitment of the discussion paper. The weights can represent institutional support, transition propensity, practical accessibility, or another empirically specified quantity. They are not assumed to be quantum amplitudes. The representation is useful only where the model supplies a defensible interpretation and parameterization of the weights.

Judgment-induced evolution can also produce feedback. A judgment changes the relational configuration; that altered configuration changes the evidence, categories, capabilities, or institutional positions available to later evaluators. A classification can become self-reinforcing because resources are allocated according to it, while a newly recognized claim can generate records and procedures that make similar future claims easier to identify. Bowker and Star’s analysis of classification infrastructures is relevant to this mechanism because classificatory systems can organize practice while rendering some features more visible and others less legible [5]. The GR language treats such feedback as part of the conversion history rather than as a reason to treat the judgment as self-justifying.

11.3 Historical and Material Mediation of Normativity

Normative judgment emerges within a history-bearing configuration. The same verbal principle can therefore generate different practical judgments when background relations differ. Property rules, labor institutions, monetary arrangements, inherited inequalities, technical infrastructures, ecological constraints, and earlier conflicts can change the entities that are visible, the alternatives that are feasible, and the consequences that follow from a conversion. Normative reasoning remains capable of criticizing these conditions, yet its practical objects and effects are mediated by them.

The mediation can be represented without treating history as a deterministic cause of judgment. Let $D(\Sigma)$ denote the modeled historical domain relevant to slice Σ , and let M_Σ collect material and institutional conditions represented within the current configuration. Equation 28 records that judgment generation is conditioned by the configuration in which evaluation occurs.

$$\Phi_{J,T}^{[\omega_\Sigma, e_T]} = \mathcal{J}_T(\omega_\Sigma, e_T(H_C)), \quad \omega_\Sigma \supseteq \{D(\Sigma), M_\Sigma\}. \quad (28)$$

Equation 28 keeps the normative theory T explicit while locating its practical application within a historically structured configuration. The notation does not imply that every relevant condition can be observed or represented completely. Section 4 already established that identification and historical reconstruction remain partial and can themselves become sites of epistemic injustice.

Institutional analysis provides an established precedent for treating rules, community attributes, and biophysical conditions as interacting elements of structured action situations rather than isolating rules from their material setting [19]. Complexity-oriented economics similarly emphasizes adaptation, historical formation, and feedback rather than treating economic organization as a timeless static mechanism [4]. The present discussion uses these perspectives as background for a narrower claim: conversion nomos and normative judgment can be historically effective only through the relational and material structures in which they are instantiated.

Historical mediation also clarifies retrospective judgment. A later evaluator can recognize evidence, harms, contributors, or dependencies that were absent from the earlier institutional description. The later judgment acts from a new configuration and can therefore support new remedies or reinterpretations. Under the historical-persistence convention used in the formal background paper, later recognition extends the modeled history rather than rewriting the earlier event structure. The normative significance of the past can change because new relations to that past are created in the present.

11.4 Nature, Technology, and Environmental Conditions

The relational mediation of normativity extends beyond human–human interaction. Material and ecological conditions shape feasible actions, exposure to harm, scarcity, dependence, and the consequences of conversion. Technologies reshape observability, coordination, production, settlement, and attribution. Symbolic and informational infrastructures influence which categories are available for expressing

claims. These conditions can therefore enter normative evaluation indirectly by changing the relational configuration on which judgment operates.

Table 10 distinguishes several classes of non-interpersonal mediation relevant to heterogeneous conversion. The categories are analytical conveniences rather than mutually exclusive domains; a payment platform, for example, is simultaneously technological, institutional, material, and symbolic.

The environmental dimension is especially important for conversion because monetary or legal settlement can close an institutional claim while material consequences continue. Compensation for environmental loss, for example, can settle a liability without restoring the ecological relations that generated the original value or absorbed the harm. The framework therefore separates settlement from material regeneration. Whether such a settlement is sufficient remains a substantive normative question for the relevant theory of justice.

Technology introduces a related reflexivity. A classification or measurement system can change the object it measures by reorganizing incentives, institutional attention, or access. AI-mediated evaluation can alter attribution and credibility structures; payment infrastructures can change which currencies or counterparties are practically usable; automated scoring can affect eligibility for later transactions. These examples support the broader point that normative judgment is mediated by the whole modeled relational configuration rather than by interpersonal reasons alone.

The framework also leaves room for unresolved contingencies. Any practical model represents only part of the larger relational environment. Noise terms, exogenous shocks, or residual variables can therefore be introduced where empirical modeling requires them. Such residuals should be interpreted as influences unresolved by the effective model, not as evidence that they lie outside the broader ontology assumed by GR.

11.5 Reflexive Evolution of Nomos

Normative judgment becomes especially consequential when repeated judgments, practices, and institutional responses contribute to the stabilization or revision of conversion nomos. Section 6 treated nomos as an emergent relational structure governing classification, admissibility, settlement, and review. The present subsection closes the reflexive loop by showing how judgments generated under one nomos can participate in producing a later nomos.

Let $\text{nom} : \Omega \rightarrow \mathcal{N}$ denote the nomos readout introduced in Section 6. After a judgment-induced transformation produces $\omega_{\Sigma'}$ through Equation 25, the effective later nomos is given in Equation 29.

$$\mathfrak{N}_{\Sigma'} = \text{nom}\left(\Phi_{J,T}^{[\omega_{\Sigma}, e_T]}(\omega_{\Sigma})\right). \quad (29)$$

Equation 29 captures a minimal form of normative reflexivity. A judgment is generated within a configuration containing an existing nomos, acts through a transformation, and contributes to a later configuration from which a modified nomos can be read. Repeated cycles can stabilize a convention, institutionalize a classification, expand a right of review, or alter the conditions under which later conversions are accepted.

Reflexivity also creates the possibility of path dependence. Early judgments can generate records, organizational routines, legal categories, or infrastructures that make some later judgments easier to express and others harder to formulate. Conversely, contestation can reopen categories and create new procedural routes. Normative evolution therefore has a historical architecture: the set of practically available normative interventions at one stage can depend on the operations and institutions generated at earlier stages.

The reflexive structure does not imply convergence toward justice. A norm can become stable because it is repeatedly reproduced by powerful institutions, because alternatives are costly to express, or because classificatory infrastructures render some harms difficult to recognize. The normative theories reviewed in Section 9 remain necessary for evaluating the resulting nomos. Emergent normativity therefore names the historical process through which normative structures become effective and revisable; it does not supply a fixed substantive criterion by which their justice is established.

Table 10: Non-interpersonal conditions that can mediate normative judgment in heterogeneous conversion.

Condition	Conversion relevance	Possible normative significance
material scarcity	energy, land, housing, transport, physical inputs	changes feasible alternatives, burdens, dependence, and practical exit capacity
ecological conditions	water systems, climate exposure, ecosystem functions, pollution	changes the distribution and persistence of harms, benefits, and regenerative conditions
technological infrastructure	platforms, payment systems, AI systems, logistics, measurement devices	changes observability, access, attribution, settlement possibilities, and concentration of interface power
informational and symbolic infrastructure	classifications, records, professional vocabularies, credentials, reputational systems	changes legibility, credibility, claim formation, and the categories available for normative reasoning
contingency and disturbance	shocks, accidents, failures, unanticipated interactions	reveals hidden dependencies, changes feasible paths, and can destabilize previously settled conversion nomos

This distinction prepares the subsequent governance analysis. If nomos is relationally generated and reflexively reproduced, governance can operate partly by shaping the conditions of normogenesis: information access, participation, interoperability, contestability, and the distribution of conversion-interface power. Such governance can influence normative evolution while leaving substantive disagreement visible rather than replacing it with a single externally imposed metric.

12 Governance of Conversion Interfaces

Section 11 described conversion nomos as historically effective through the relational configurations in which judgment, practice, institutions, and material conditions interact. The present section develops the corresponding governance problem. Its role is to distinguish governance of a conversion interface from direct determination of a substantive conversion outcome. The objective is to identify several relational conditions that can be governed—including participation, classification, information, interoperability, concentration of interface power, contestability, and revision—while leaving the substantive nomos partly open to distributed normogenesis. The discussion is procedural and institutional rather than a proposal for a universal institutional design. It uses the relational language developed in earlier sections to separate bottom-up norm formation, coordinating functions, infrastructural power, and mechanisms of revision.

Figure 8 summarizes the architecture. Conversion practices and interactions contribute to effective nomos, while the resulting nomos shapes later practices. Governance can intervene in the conditions through which this cycle operates without directly fixing every substantive conversion rule. The distinction is analytical: real institutions frequently combine coordinating, classificatory, distributive, and substantive rule-setting functions.

12.1 Bottom-Up Normogenesis

A relational account of conversion nomos gives distributed practice a substantive role. Repeated exchanges, local conventions, professional routines, community standards, technical protocols, and patterns of mutual adjustment can contribute to the stabilization of conversion rules even when no single actor designed the resulting arrangement. Section 6 treated this stabilization as historically contingent rather than automatically legitimate. The governance implication is that substantive norms can emerge through interactions distributed across several sites rather than requiring a single authoritative origin.

Ostrom’s institutional analysis provides an established framework for understanding rule formation across nested and partially self-organized action situations. Her work emphasizes that rules, community attributes, and biophysical conditions interact, and that rule-making itself can occur at several levels

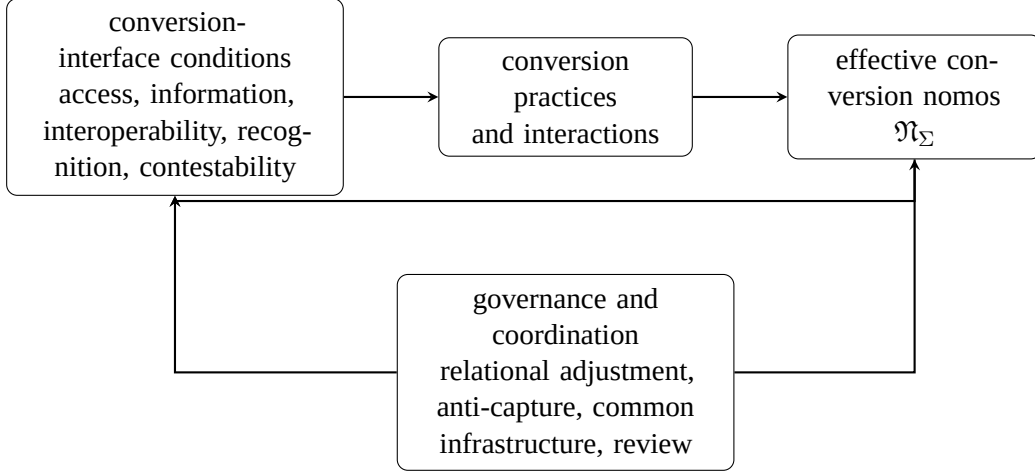


Figure 8: Governance of conversion interfaces. Conversion practices contribute to effective nomos, and effective nomos shapes later practices. Governance can modify the relational conditions under which this cycle operates, including access, information, interoperability, recognition, contestability, concentration of interface power, and review. The diagram isolates a distinct coordinating function that can coexist with substantive rule-setting while leaving many conversion outcomes open to distributed formation.

rather than being exhausted by one centralized decision point [19]. The present discussion uses that insight cautiously. Bottom-up normogenesis refers to distributed participation in the formation and revision of effective conversion nomos; it does not imply that every emergent rule is normatively justified or that decentralized processes are free from domination.

This qualification matters because relational emergence can reproduce inherited asymmetries. A conversion convention can stabilize because powerful actors control infrastructure, because alternatives are costly, because a classification has become institutionally entrenched, or because those most affected lack standing to contest it. Consequently, bottom-up emergence and equitable participation remain analytically distinct. A conversion norm can be locally generated while still reflecting highly unequal relational conditions.

For governance analysis, the practical question is therefore less whether a norm is centralized or decentralized in the abstract than how the relevant generative process is structured. Useful questions include which actors can enter the process, whose classifications become authoritative, which alternatives remain practically available, how information is distributed, and whether the rule can be revised when its consequences become visible. These conditions prepare the distinction between substantive norm production and central coordination developed in the next subsection.

12.2 Central Coordination and Relational Adjustment

Distributed normogenesis does not remove the possible functional value of coordinating nodes. Conversion systems frequently require common records, interoperable standards, adjudication, liquidity provision, shared measurement conventions, or procedures for resolving conflicts between local rules. A coordinating institution can therefore affect the relational conditions of conversion without determining the complete substantive content of every conversion.

The present framework calls this function *relational adjustment*. A governance intervention is represented as a state-changing transformation Φ_g acting on a modeled relational configuration. Its distinctive analytical target is a set of interface conditions rather than a predetermined numerical conversion outcome. Let $\mathbf{k}_C(\omega)$ denote a context-specific profile containing the conversion conditions selected for governance analysis. A schematic representation is stated in Equation 30.

$$\mathbf{k}_C(\omega) = (\text{Acc}_C, \text{Inf}_C, \text{Int}_C, \text{Con}_C, \text{Rev}_C), \quad (30)$$

where Acc_C denotes access to the conversion interface, Inf_C relevant information conditions, Int_C interoperability among conversion mechanisms, Con_C contestability, and Rev_C revision capacity. Equation 30 is a bookkeeping device rather than a universal index. Different conversion domains can require different components and need not admit scalar measurement of each component.

A coordinating intervention can then modify the relational configuration and thereby change this profile. Equation 31 represents that limited function.

$$\omega_{\Sigma'} = \Phi_g(\omega_{\Sigma}), \quad \mathbf{k}_C(\omega_{\Sigma'}) \neq \mathbf{k}_C(\omega_{\Sigma}). \quad (31)$$

Equation 31 does not require Φ_g to specify the subsequent nomos directly. The effective nomos remains a property of the subsequent configuration, while governance changes some of the conditions through which later practices and judgments operate.

This distinction helps avoid a simple opposition between central planning and spontaneous order. A central node can supply common infrastructure, maintain interoperability, limit exclusion, or coordinate emergency response while leaving substantial room for local rule formation. Conversely, a formally decentralized system can remain dependent on a highly concentrated payment rail, classification standard, data infrastructure, or platform. The distribution of governance functions therefore matters more than a binary label of centralized or decentralized organization.

12.3 Classification and Recognition Infrastructure

Conversion begins with epistemic and institutional operations that determine what entities, claims, and value forms enter the conversion interface. Governance therefore includes the infrastructure of classification and recognition. Section 4 described entity identification as a partial and potentially biased operation. The present subsection considers the institutional side of that problem: categories, registries, accounting systems, standards, documentation requirements, and recognition procedures can structure which entities become legible for conversion.

Bowker and Star show that classification systems can become infrastructural precisely because they organize practice while fading from immediate attention [5]. In conversion settings, such infrastructures can determine whether a contribution counts as labor, whether a claim qualifies as property, which currency or credential is accepted, or which evidence is sufficient to establish an entitlement. Governance of classification infrastructure therefore affects conversion before bargaining over a ratio begins.

A relational governance approach does not imply that every category should remain permanently open. Stable categories can reduce coordination costs and support interoperability. The justice-relevant issue is whether classificatory stability is accompanied by mechanisms for detecting systematic omission, reclassification, and contextual mismatch. An institution can maintain common standards while also preserving channels through which actors challenge the categories that determine their standing.

Recognition infrastructure is closely related but analytically distinct. Classification assigns an entity to a category; recognition gives that classified entity practical standing within an institutional process. A community can be accurately identified yet lack standing to participate in a conversion decision. A contribution can be documented yet excluded from an attribution procedure. Governance must therefore consider both representational adequacy and the institutional consequences attached to recognition.

Table 11 summarizes several governance functions that operate at different locations of the conversion interface.

12.4 Contestability and Revision Infrastructure

Because conversion nomos is historically generated and conversion consequences can become visible only after settlement, governance requires infrastructure for contestation and revision. Ceva's proceduralist approach is relevant because it emphasizes the terms under which parties can participate in political interactions amid value conflict rather than assuming that substantive disagreement will disappear [6]. Hirschman's distinction among exit, voice, and loyalty provides a complementary vocabulary for

Table 11: Selected governance functions within heterogeneous conversion. The table separates relational functions rather than prescribing one institutional form.

Governance function	Relational object	Typical concern
Access governance	Entry to conversion and recognition procedures	Exclusion, unequal standing, prohibitive entry conditions
Classification governance	Categories, records, standards, evidentiary schemas	Omission, conflation, historical truncation, rigid categories
Interoperability governance	Interfaces among currencies, standards, registries, platforms	Lock-in, incompatible systems, concentrated switching costs
Information governance	Disclosure, measurement, observability, documentation	Information asymmetry, hidden burdens, inaccessible evidence
Contestability governance	Objection, voice, appeal, counter-classification	Capture, unreviewable decisions, weak procedural standing
Revision governance	Reopening, rectification, rule amendment, sunset or review mechanisms	Path dependence, irreversible settlement, obsolete nomos
Coordination governance	Shared infrastructure and cross-scale compatibility	Fragmentation, cascading incompatibility, coordination failure

analysing whether dissatisfied participants can leave an arrangement or attempt to change it from within [13].

Contestability concerns the capacity to challenge an identification, attribution, conversion rule, settlement, or institutional interpretation. Revision concerns the capacity of the system to alter a stabilized rule or reopen a settled process under specified conditions. The two are related but distinct. An institution can permit objections while possessing no meaningful mechanism for revising the underlying rule. Conversely, a rule can be formally revisable by a central authority while affected participants lack standing to trigger review.

The relational framework therefore treats revision capacity as part of the conversion interface rather than as an exceptional event added after failure. A conversion system with strong path dependence can accumulate errors or mismatches when classifications, technologies, ecological conditions, or power relations change faster than the nomos governing them. Periodic review, appeal procedures, sunset provisions, reversible pilot arrangements, and staged settlement are examples of institutional forms that can preserve revision capacity, although their appropriateness depends on the conversion domain.

Revision infrastructure also affects the distribution of irreversibility. If one party can reopen a conversion while another cannot, or if a powerful institution can reinterpret rules retrospectively while affected subjects are bound by settlement, formal revisability can coexist with relational asymmetry. Governance analysis should therefore examine who can initiate revision, what evidence is admissible, which burdens of proof apply, and what consequences remain reversible after the process is reopened.

12.5 Relational Governance of Normogenic Conditions

The preceding subsections support a limited conception of relational governance. Governance can shape the conditions under which conversion nomos emerges, stabilizes, and changes while leaving substantive value disagreement visible. The central analytical distinction is between governing the *conditions of normogenesis* and prescribing a complete substantive conversion rule for every case.

A relational governor still operates under higher-level normative commitments. Protecting participation, interoperability, contestability, or revision already expresses substantive commitments about the conditions of collective conversion. These commitments can often be represented as constraints on the conversion process while leaving the substantive ordering of heterogeneous values partly open. Such constraints can support plural local practices and theory-relative disagreement while limiting forms of capture that would otherwise close the process of norm formation.

A useful representation is to treat governance as modifying the configuration from which later nomos is read. Let $\text{nom} : \Omega \rightarrow \mathcal{N}$ be the nomos readout introduced in Section 6. Equation 32 states the relation between governance and subsequent nomos.

$$\mathfrak{N}_{\Sigma'} = \text{nom}(\Phi_g(\omega_{\Sigma})) . \quad (32)$$

Equation 32 leaves open whether a particular intervention changes the substantive nomos, preserves it, or creates several competing local nomoi. The representation records only that governance can alter the relational conditions from which effective nomos subsequently emerges.

The practical attraction of this approach is its compatibility with multi-level governance. Local communities, professional associations, firms, courts, states, international bodies, and technical standards organizations can perform different coordination functions without being collapsed into a single sovereign source of value. Ostrom's emphasis on institutional diversity is relevant here because it treats governance arrangements as heterogeneous combinations of rules and action situations rather than assuming one universally adequate institutional form [19].

Relational governance remains one institutional dimension of conversion justice. Persistent inequality, epistemic distortion, ecological constraint, concentrated infrastructure, or coercive dependence can shape normogenesis even when formal participation and revision exist. Substantive evaluation therefore remains available through the normative perspectives in Section 9. Section 13 applies the combined framework to several concrete conversion cases.

13 Illustrative Conversion Cases

The role of this section is to test the analytical vocabulary developed in the preceding sections against several recurrent forms of heterogeneous conversion. The objective is illustrative rather than empirical: each case is presented as a stylized conversion structure that shows how entity identification, commensuration, nomos, procedure, distribution, and post-conversion relations can become jointly relevant. The examples do not establish a single justice criterion. They show how the same conversion history can expose different normative questions depending on the value forms, institutions, and relational structures involved.

Table 12 summarizes the five cases. The table separates the visible conversion interface from the wider relational questions that become available once the conversion is treated as a history rather than as a scalar ratio.

13.1 Labor and Wage Conversion

Labor-to-wage conversion is a familiar example because it appears to admit a direct monetary representation: a period or unit of labor is compensated by a specified wage. The visible interface can therefore be written schematically as $\text{labor} \rightsquigarrow \text{money}$. The relational framework complicates that representation by asking what is being identified as labor, whose contribution is being attributed, which risks are attached to the work, and which conditions determine the meaning of the monetary amount received.

The first issue concerns entity identification. A worker can be represented narrowly through hours worked and contractual output, or more broadly through skill formation, prior education, care and social reproduction, team dependence, organizational infrastructure, and exposure to occupational risk. Section 4 showed that such identifications are necessarily partial. A wage procedure can therefore be procedurally regular while still relying on an informational structure that omits relationally relevant features.

The second issue concerns attribution. Production is often co-generated across several persons, infrastructures, and institutional conditions. The visible wage contract usually attributes a specific remunerated contribution to an individual worker, while other contributions can be compensated through salaries

Table 12: Illustrative heterogeneous conversion cases and selected justice-relevant loci. The entries identify analytical questions rather than predetermined justice conclusions.

Case	Visible conversion interface	Relational structures requiring identification	Selected justice-relevant questions
Labor and wage	Labor contribution $\rightsquigarrow$ monetary wage	Worker history, organization, co-workers, care and reproduction, legal and material conditions	Attribution, bargaining conditions, risk, capability consequences, future dependency
Currency and international conversion	Currency $M_i \rightsquigarrow M_j$	Issuers, payment infrastructures, markets, reserves, legal jurisdictions, international relations	Conversion access, hierarchy, exchange-rate risk, settlement dependence, relational stability
Environmental compensation	Ecological loss $\rightsquigarrow$ compensatory value	Ecosystem, affected communities, future users, legal claimants, material dependencies	Entity recognition, partial commensurability, irreversibility, incidence, standing
Knowledge and symbolic value	Knowledge contribution $\rightsquigarrow$ credit, status, ownership, or payment	Contributors, prior knowledge, institutions, infrastructures, archives, audiences	Attribution, recognition, epistemic visibility, symbolic conversion, revision
Retrospective recognition	Earlier event or contribution $\rightsquigarrow$ later claim or status	Historical record, present interpreters, successors, institutions, surviving consequences	Historical truncation, delayed recognition, reopened settlement, evidentiary asymmetry

elsewhere in the organization, public provision, unpaid activity, capital income, or not at all. The relational framework does not supply an automatic rule for reallocating these contributions. It makes the attribution structure explicit so that different normative theories can evaluate it on their own terms.

The third issue concerns consequence incidence. Two workers receiving the same nominal wage can occupy different material and relational positions. Sen's capability-oriented work is relevant to this distinction because equal resource bundles need not generate equal substantive opportunities [23]. Conversion justice can therefore involve the relation between wage, risk, legal protection, care obligations, public services, mobility, and the future option set available to the worker.

Finally, the labor example shows why a conversion ratio and a conversion history should remain distinct. A wage can be agreed under different recognition procedures, bargaining conditions, settlement rules, and revision mechanisms. The numerical ratio can remain unchanged while the procedural and relational history differs substantially. The case therefore connects distributive evaluation with the procedural and epistemic dimensions developed in Sections 7 and 4.

13.2 Currency and International Conversion

International currency conversion provides a case in which both sides of the visible conversion are already institutional value forms. A quoted exchange rate converts one monetary unit into another, yet the two currencies occupy different positions within domestic institutions, financial markets, payment infrastructures, and international political relations. Section 5 therefore treated currency conversion as a higher-order equivalence problem rather than as a neutral translation between identical monetary objects.

Consider a conversion from currency M_i to currency M_j . The quoted rate records one relation between them, while the wider conversion history can include access to banking infrastructure, settlement location, capital controls, transaction costs, liquidity conditions, reserve practices, contract denomination, and the possibility of using a third vehicle currency. Cohen's analysis of currency power is relevant

because international currencies can differ in the extent to which they perform cross-border monetary functions and thereby acquire differentiated forms of structural influence [7]. BIS evidence likewise documents the uneven international reach of major currencies across financial activities [16].

This differentiated structure affects justice without determining it automatically. An actor with access to several liquid currencies can often redistribute exchange-rate risk more readily than an actor whose income, debt, and consumption are concentrated in one currency. A state or organization that can denominate liabilities in a widely accepted currency may face different conversion constraints from one that must acquire foreign currency before settlement. The justice-relevant object is therefore partly the distribution of conversion capacity itself.

The case also illustrates relational stability. Gold and other reserve assets can remain usable across some changes in bilateral relations because their conversion possibilities are supported by broader relational structures. The discussion in Section 5 treated this as a qualified form of relational invariance rather than as intrinsic value. In justice analysis, the corresponding question concerns which actors possess access to comparatively robust value-storage and conversion pathways and which actors remain exposed to narrower institutional channels.

International currency conversion thus joins monetary economics and political economy without collapsing one into the other. Exchange-rate formation remains an empirical economic problem. Conversion justice concerns additional questions about access, risk incidence, institutional dependence, hierarchy, and the downstream distribution of relational options.

13.3 Environmental Compensation

Environmental compensation provides a particularly clear example of partial commensurability. A legal or administrative process can assign monetary compensation to ecological loss, land degradation, displacement, or loss of access to environmental goods. The practical need for a compensatory metric does not imply that the affected ecological and social values are fully exhausted by the monetary amount.

The first challenge is identification. The relevant entity may include a legally owned parcel, an ecosystem, a livelihood relation, a cultural site, an affected community, future users, or several overlapping structures. Different identification choices can produce different compensation domains before any numerical valuation occurs. A procedure that recognizes only legally documented ownership can omit ecological dependence or forms of use that are difficult to encode through existing registries.

The second challenge is commensuration. Monetary compensation can create a practical settlement interface while preserving residual value dimensions that remain outside the metric. This is precisely the situation described by partial commensurability in Section 2. The justice question can therefore concern whether the conversion procedure acknowledges the limits of its own metric, whether non-monetary remedies remain available, and whether irreversible losses are treated differently from reversible ones.

The third challenge is incidence across time. Environmental loss can redistribute burdens toward actors who were absent from the original decision and toward future relational configurations that cannot participate directly in present bargaining. The framework does not resolve questions of representation for future persons or nonhuman entities. It identifies the problem: the set of affected relations can extend beyond the set of legally recognized contracting parties.

This case therefore exposes a general feature of heterogeneous conversion. Compensation can be institutionally necessary and normatively significant while remaining ontologically incomplete as a representation of what was lost. Conversion justice can require attention both to the settlement achieved and to the values and relations that remain outside the settlement metric.

13.4 Knowledge and Symbolic Value

Knowledge conversion involves transitions among contribution, recognition, authorship, ownership, reputation, institutional status, and monetary reward. These value forms are heterogeneous because they rely on different recognition systems and can move through different conversion interfaces. A scholarly

contribution, for example, can generate symbolic recognition without direct payment, while the same contribution can later affect employment, grant access, licensing, or institutional standing.

The conversion process therefore begins with epistemic visibility. Bowker and Star's analysis of classification infrastructures is relevant because systems of categorization can determine which contributions become legible within institutions [5]. A contribution can exist within a relational history yet remain weakly recognized because it does not fit the categories through which authorship, credit, ownership, or expertise are recorded.

Attribution is correspondingly important. Knowledge is often historically cumulative and institutionally supported. An identified contribution can depend on prior work, collaborators, technical infrastructure, archives, educational institutions, and public resources. The relational framework does not imply that every historical dependency creates an equal present claim. It treats the attribution boundary as an explicit normative and epistemic choice rather than as a transparent fact.

Symbolic value also demonstrates performativity. Recognition can change the later relational position of the recognized subject or contribution. A prize, citation, credential, legal status, or institutional classification can modify access to future opportunities and can influence later judgments of value. Recognition therefore has both epistemic and generative dimensions: it represents something about a contribution and can alter the conditions under which that contribution is subsequently converted.

This case is especially relevant to emerging technological environments. New tools can change the practical relation among authorship, contribution, production, and evaluation. The present paper does not propose a substantive rule for these emerging disputes. The relational framework provides a way to separate contribution history, identification, attribution, recognition, conversion, and post-recognition consequences so that different normative theories can address them without treating symbolic and monetary value as interchangeable.

13.5 Historical Recognition and Retrospective Claims

Retrospective conversion occurs when later recognition changes the practical significance of an earlier event, contribution, loss, or settlement. The historical event itself can remain fixed within the adopted Historical Persistence Convention while new evidence, classifications, institutions, or normative judgments generate later claims. This structure is relevant to restitution, delayed attribution, retrospective compensation, historical reclassification, and renewed recognition of previously marginalized contributions.

The central problem is temporal asymmetry. Evidence available at the later slice can differ from the evidence available when the original conversion occurred. Recognition can therefore arrive after rights have been transferred, settlement has closed a claim, records have been lost, institutions have changed, or affected persons are no longer present. Fricker's work on epistemic injustice provides one vocabulary for understanding how credibility and interpretive resources can shape whose experiences become intelligible within a knowledge system [12]. The present case extends the analytical horizon by asking how later changes in epistemic structure interact with already-realized conversion histories.

Retrospective claims can be represented as extensions of an earlier history rather than as literal rewriting of the past. A later recognition event adds new relations to an existing historical structure and can activate revision, restitution, or symbolic-status procedures in the present. This representation preserves a distinction between the occurrence of an earlier event and the later institutional significance attached to it.

The justice problem then divides into several questions. One concerns historical identification: which earlier relations are relevant to the later claim? Another concerns evidentiary asymmetry: which records survived and whose testimony remains available? A third concerns revision: which settled conversions can be reopened, by whom, and under what burdens of proof? A fourth concerns present incidence: who bears the costs or receives the benefits of retrospective correction when original participants are absent or relational positions have changed substantially?

The example therefore connects epistemic justice, procedural revision, and historical dependence. It

also illustrates the broader claim of this paper: heterogeneous conversion justice cannot be reduced to the fairness of the ratio visible at the moment of exchange. The normative object can include the longer history through which recognition, settlement, and revision become possible.

14 Structural Limits of Heterogeneous Conversion

The preceding sections developed heterogeneous conversion as a relational process involving identification, commensuration, procedure, institutional stabilization, power, distribution, and normative evaluation. The role of this section is to identify limits internal to that architecture. The objective is not to argue that heterogeneous conversion is generally illegitimate or impossible. Many practical institutions require conversion in order to coordinate exchange, allocate compensation, recognize claims, or settle obligations. The present analysis instead distinguishes five limits that remain relevant even when a conversion procedure functions effectively: ontological reduction, epistemic compression, partial commensurability, irreversibility, and normative underdetermination.

These limits arise at different stages of the conversion process. Ontological reduction concerns the relation between a richer relational entity and the value-form through which it becomes convertible. Epistemic compression concerns the finite informational representation available to a conversion procedure. Partial commensurability concerns the scope within which heterogeneous values can be compared. Irreversibility concerns the possibility that completed conversions change the relational configuration in ways that cannot be fully undone. Normative underdetermination concerns persistent disagreement among evaluative theories even after the descriptive conversion history has been specified. Table 13 summarizes these five locations.

14.1 Ontological Reduction

Heterogeneous conversion usually operates on a represented value-form rather than on the full relational structure from which that value emerges. A day of labor can be represented through hours, occupational categories, output measures, or contractual duties. An ecosystem can be represented through property boundaries, restoration costs, expected services, or compensatory damages. Knowledge can be represented through authorship, citation, intellectual-property rights, credentials, or marketable outputs. Each representation selects some features of the relevant relational structure and leaves others outside the operative conversion interface.

Let $\mathfrak{E}_a$ denote an identified relational entity and let ρ_c denote a conversion-oriented representation associated with context c . Equation 33 defines the represented conversion object.

$$\rho_c : \mathfrak{E}_a \longrightarrow R_a^{(c)}, \quad (33)$$

where $R_a^{(c)}$ contains the features of $\mathfrak{E}_a$ rendered operative for the conversion procedure. Equation 33 is intentionally broad. The codomain can contain prices, categories, rights, indices, contractual quantities, or other institutionally legible forms.

The reduction performed by ρ_c can be analytically necessary. A wage system cannot continuously encode the complete relational history of every worker, and a court cannot reconstruct every ecological, social, and historical relation implicated by each compensation claim. The justice problem arises when the reduced representation is treated as if it exhausted the entity whose value is being converted. The distinction between practical representation and ontological exhaustion therefore matters independently of whether the resulting conversion ratio is accurate relative to the chosen representation.

This limit also clarifies why heterogeneous conversion can create apparently precise outputs while remaining substantively incomplete. Numerical precision is a property of the represented conversion object. It does not establish that the representation contains every relation relevant to the value under consideration. The formal distinction developed in Section 4 between relational entities and their institutionally legible representations therefore remains active throughout the conversion process.

Table 13: Five limits of heterogeneous value conversion. The limits identify analytical boundaries of conversion rather than predetermined judgments of injustice.

Limit	Primary location	Analytical concern	Justice relevance
ontological reduction	value representation	richer relational structures are represented through narrower conversion objects	relevant relations can disappear before valuation begins
epistemic compression	observation and evidence	finite classifications, records, and measurements omit parts of relational history	omission can affect standing, attribution, credibility, and compensation
partial commensurability	comparison and metric construction	comparability can hold under one covering consideration while remaining incomplete under others	a practical common measure can exceed its justified scope
irreversibility	post-conversion configuration	settlement, transfer, destruction, or institutional change can narrow feasible reversal paths	later recognition may require repair rather than simple restoration
normative underdetermination	evaluative layer	different theories can evaluate the same conversion history through distinct normative commitments	a common descriptive language does not generate one final justice verdict

14.2 Epistemic Compression

Ontological reduction concerns the form in which an entity becomes convertible; epistemic compression concerns the finite evidence through which that entity is known. Every practical conversion system works with bounded records, classifications, testimony, measurements, databases, models, and institutional memories. These materials can preserve substantial information while still providing only a partial view of the relevant relational history.

Bowker and Star’s analysis of classification infrastructures is useful here because categories do not merely store information; they organize which distinctions become institutionally durable and operationally visible [5]. Fricker’s account of epistemic injustice adds a normative vocabulary for cases in which credibility and interpretive resources are distributed in ways that disadvantage some knowers [12]. Within heterogeneous conversion, these concerns can arise before valuation itself, because evidence structures affect which entities are recognized, which contributions are attributed, and which losses become compensable.

For a relational domain U and an epistemic window W , let κ_W denote a finite compression into institutionally available evidence. Equation 34 represents this operation.

$$\kappa_W : U \longrightarrow \hat{U}_W. \quad (34)$$

The compressed representation $\hat{U}_W$ can preserve substantial structure while omitting events or relations outside the evidentiary window. Equation 34 does not define a universal measure of information loss. Its role is to separate the modeled relational domain from the evidence actually available to a conversion institution.

Compression can occur through historical truncation, coarse categories, missing records, inaccessible testimony, measurement thresholds, or institutional scale. The same entity can therefore be represented differently by two institutions even when both operate competently according to their own evidentiary standards. Section 4 treated such differences as possible sites of epistemic injustice when they systematically affect recognition, attribution, credibility, or conversion outcomes. The present subsection adds

a limit claim: complete epistemic recovery of the relational history should not be presumed as a routine property of conversion.

This limit also constrains retrospective correction. Later evidence can expand the epistemic window and alter the recognized history, yet the newly available representation is still produced from a later relational position with its own records, categories, and missing materials. Retrospective recognition can therefore improve a conversion history without providing an unmediated reconstruction of the past.

14.3 Partial Commensurability

Commensuration makes heterogeneous values comparable under a specified covering consideration. A wage scale can compare different forms of labor for payroll purposes; a damages schedule can compare injuries for legal compensation; a currency market can compare monetary units for exchange; a cost-benefit procedure can translate heterogeneous effects into a common accounting framework. Espeland and Stevens describe commensuration as a social process through which qualities are transformed into a common metric [11]. The existence of such a metric does not imply complete comparability across every normatively relevant dimension.

Let $\asymp_c$ denote comparability under context or covering consideration c . Equation 35 defines a context-indexed comparability relation.

$$A \asymp_c B \iff A \text{ and } B \text{ are comparable for the purposes specified by } c. \quad (35)$$

Equation 35 permits A and B to be comparable under one purpose and incompletely comparable under another. A monetary amount can therefore settle a contractual obligation without establishing that the monetary metric exhausts the personal, ecological, historical, or symbolic significance of the converted value.

Philosophical work on incommensurable values distinguishes several forms of comparison difficulty and emphasizes that comparability can depend on the covering consideration under which alternatives are assessed [2]. This observation is especially important for heterogeneous conversion because institutional success can obscure the restricted domain of a metric. A compensation procedure can be administratively complete while the underlying values remain only partially commensurable.

Partial commensurability therefore creates a scope problem for conversion justice. A metric can be justified for one institutional task and extended beyond that task through repetition, convenience, or power. Monetary valuation, for example, can provide a workable settlement interface while becoming an inappropriate substitute for recognition, restoration, participation, or ecological regeneration. The formal framework does not supply a universal boundary for such extensions. It makes the boundary itself available for normative evaluation.

14.4 Irreversibility

A completed conversion can alter the relational configuration in ways that make exact restoration unavailable. The relevant change can be material, legal, institutional, ecological, temporal, or symbolic. Labor time has already been expended. A destroyed habitat may not be reproducible through monetary compensation. Ownership can be transferred through chains of subsequent transactions. Information can be disclosed and become impossible to retract. A settlement can alter evidentiary and legal positions even when later review remains available.

For a completed conversion history H_C ending in configuration ω^+ , define the set of admissible repair or reversal histories by Equation 36.

$$\text{Rev}(H_C, \omega^+) = \{H^- : H^- \text{ begins from } \omega^+, \\ H^- \text{ is admissible and directed toward repair or reversal}\}. \quad (36)$$

The set in Equation 36 can be empty, restricted, or capable only of approximate repair. The definition deliberately includes repair as well as reversal because many conversion effects cannot be removed by applying an inverse transaction.

Irreversibility changes the significance of procedural timing. Recognition that occurs after settlement can still justify compensation, restitution, reopened review, or institutional reform, yet those remedies act on a relational configuration already changed by the original conversion. Section 7 therefore treated revision access as distinct from an assumption that the original state can simply be restored.

The distinction also matters for environmental and historical cases discussed in Section 13. Monetary compensation can create resources for repair while leaving irreversible ecological loss. Retrospective recognition can correct status, attribution, or compensation while leaving earlier opportunities unavailable. Conversion justice can therefore require attention to the feasible repair structure of a history, not only to whether an inverse numerical transfer can be specified.

14.5 Normative Underdetermination

The preceding limits remain descriptive until a normative theory specifies why they matter and how they should be evaluated. Even a highly detailed conversion history does not by itself determine one justice verdict. Section 9 showed that consequential, entitlement-based, Rawlsian, capability-oriented, exploitation, relational-egalitarian, procedural, epistemic, and pluralist approaches select different normative features from the same history. Section 10 then represented this plurality through theory-relative identification and evaluation.

Normative underdetermination therefore refers to the possibility that a shared descriptive history remains compatible with several internally coherent evaluations. Let T_1 and T_2 denote two normative perspectives operating on the same instantiated conversion history H_C . Equation 37 states the minimal possibility of evaluative divergence.

$$e_{T_1}(H_C) \neq e_{T_2}(H_C). \quad (37)$$

The symbol in Equation 37 indicates non-identity of evaluative outputs; it does not presume that the outputs belong to a common cardinal scale. One theory can emphasize entitlement history, another capability consequences, and another domination or procedural standing. Their disagreement can therefore concern the evaluative space itself rather than merely a different numerical score within one shared metric.

This limit is especially important for an integrative framework. Translation across theories can clarify where disagreement arises, but translation does not establish equivalence among normative commitments. The paper's relational language can identify whether disagreement concerns entity boundaries, informational bases, baselines, procedural requirements, priority relations, or commensurability. It cannot legitimately convert those disagreements into one final metric unless an additional normative argument supplies the required ordering.

Normative underdetermination also limits the role of emergent nomos. A conversion rule can become historically stabilized, widely accepted, and institutionally effective while remaining contestable under one or more theories of justice. Conversely, persistent normative disagreement does not prevent a conversion institution from operating. The distinction between effective nomos and justified nomos therefore remains central to the paper's approach.

Taken together, the five limits in Table 13 constrain any attempt to identify conversion justice with a single ratio, procedure, or metric. Heterogeneous conversion can remain necessary and institutionally productive while retaining ontological, epistemic, comparative, temporal, and normative remainders. The following discussion section draws these limits together and develops the broader implications for conversion architecture, normogenesis, and relational justice.

15 Integrative Implications and Research Agenda

The preceding sections treated heterogeneous value conversion as a process that extends beyond the visible ratio or settlement through which one value form is rendered into another. The role of this section is to consolidate the analytical implications of that approach. The objective is to clarify what changes

when conversion justice is examined across identification, commensuration, procedure, institutional stabilization, distribution, normogenesis, and subsequent relational consequences. The discussion remains synthetic. It does not introduce a universal criterion of just conversion, and it preserves the theory-relative structure developed in Section 9 and Section 10.

Five implications organize the section. First, conversion justice extends beyond the fairness of a numerical ratio. Second, justice can attach to the architecture through which entities become identifiable, comparable, convertible, and revisable. Third, conversion nomos raises a separate problem concerning the justice of normogenesis. Fourth, common equivalents such as money can reorganize relations as well as represent them. Fifth, several unresolved questions remain before the framework can support stronger normative or empirical claims. These implications should be read as a research agenda for heterogeneous conversion rather than as conclusions that settle the underlying normative disputes.

15.1 Multi-Layer Structure of Conversion Justice

A visible conversion often invites a ratio-centered question. A wage can be expressed as money per hour, a currency transaction as units of one currency per unit of another, and compensation as a monetary amount assigned to a recognized loss. Ratio-centered analysis is indispensable for many economic and legal purposes. The present framework adds that the ratio is produced within a wider conversion history whose normative relevance can begin before the ratio is calculated and continue after settlement.

The epistemic conditions discussed in Section 4 illustrate the upstream side of this problem. Before a wage, compensation amount, or exchange relation can be evaluated, an institution must identify the relevant entity, classify its features, determine which records and testimony count as evidence, and attribute claims or contributions. A conversion ratio can therefore be internally consistent relative to a representation that remains incomplete or systematically distorted. Bowker and Star's work on classification infrastructures is relevant because classifications organize practical visibility and action, while Fricker's work identifies forms of epistemic disadvantage that can arise through credibility and interpretive resources [5, 12]. The implication for conversion justice is limited but important: fairness at the level of the final ratio does not resolve epistemic problems embedded in the construction of the objects being compared.

The procedural analysis in Section 7 adds a second layer. Standing, participation, information, bargaining conditions, settlement, revision, and the ordering of conversion-related operations can matter even when the visible transfer is unchanged. Ceva's proceduralist approach is useful here because it directs attention to the terms of interaction under persistent value conflict rather than assuming that disagreement can always be eliminated through a substantive ranking [6]. The present paper extends that concern to heterogeneous conversion by treating procedure as part of the conversion history itself.

Downstream consequences add a third layer. Section 8 distinguished immediate allocation from risk incidence, dependency, exit capacity, future optionality, and subsequent relational structure. A transaction that appears balanced at settlement can expose one party to greater future risk, narrow its feasible exit options, or increase dependence on an infrastructure controlled by another actor. Sen's capability-oriented distinction between resources and substantive opportunities is relevant to this point because equal or comparable resources need not generate equal practical possibilities [23]. Hirschman's analysis of exit and voice similarly clarifies why the availability of alternatives can matter alongside the terms of a current exchange [13].

These layers support a broader interpretation of conversion justice. The object of evaluation can include the construction of the conversion objects, the procedure through which conversion occurs, and the relational configuration produced afterward. This interpretation does not imply that every conversion must be evaluated through every possible dimension. Different institutions and normative theories can legitimately select different scopes. The analytical claim is that a ratio alone does not exhaust the possible locations of injustice in heterogeneous conversion.

15.2 Justice of the Conversion Architecture

The phrase *conversion architecture* refers here to the interacting arrangements through which heterogeneous entities become recognizable, comparable, convertible, settled, and revisable. The architecture includes classificatory systems, evidentiary rules, metrics, currencies, legal categories, payment or settlement infrastructures, procedural rights, review mechanisms, and the institutional distribution of authority over these components. Section 12 treated several of these elements as conversion interfaces because they mediate entry into and movement through a conversion process.

Justice of the conversion architecture concerns the structure of these interfaces rather than only the substantive value assigned in a particular case. Espeland and Stevens' account of commensuration is relevant because common metrics are socially organized accomplishments rather than neutral reflections of already homogeneous objects [11]. Desan's historical account of money similarly shows that monetary arrangements are institutionally constructed and can reorganize economic relations [8]. These literatures suggest that conversion infrastructures can be analytically consequential even when individual exchanges appear voluntary or technically correct.

Several architectural questions follow. One concerns access: which actors, claims, currencies, documents, or forms of value can enter the conversion procedure. A second concerns translation: which dimensions of a relational entity survive the move into a legible conversion form. A third concerns control: who can define classifications, metrics, accepted evidence, settlement infrastructure, and revision rules. A fourth concerns interoperability: whether actors can move among alternative systems or become locked into one conversion interface. A fifth concerns repair: whether later evidence or changed conditions can reopen a settled conversion.

Power therefore appears at several locations rather than only at the bargaining table. Section 6 distinguished power over classification, commensuration, access, settlement, and revision. Cohen's analysis of currency power offers a monetary example because international currency use can distribute autonomy, adjustment burdens, and influence asymmetrically across actors [7]. In other domains, equivalent architectural asymmetries can arise through proprietary standards, evidentiary rules, professional classifications, or concentrated platforms. The common structure is that control over the interface can affect which conversions are possible and on what terms.

An architectural approach also helps separate efficiency from justice without treating them as opposites. Standardization can reduce transaction costs, improve interoperability, and make large-scale coordination possible. Stable classifications can support administration, and common monetary units can enable exchange across otherwise heterogeneous goods and services. The same arrangements can also omit relevant distinctions, concentrate control, or transfer risks in ways that become normatively contested. The justice question therefore concerns how a conversion architecture distributes recognition, access, burdens, options, and revision capacity under the purposes for which the architecture is used.

15.3 Justice of Normogenesis

Conversion rules rarely appear fully formed. Section 6 treated conversion *nomos* as historically generated through repeated practice, institutionalization, contestation, political power, material constraints, and prior conversion histories. This treatment creates a second-order normative problem. A norm can be socially effective and historically stable while remaining normatively objectionable under one or more theories of justice. Emergence and justification therefore remain analytically distinct.

Justice of normogenesis concerns the conditions under which conversion *nomos* is generated, stabilized, contested, and revised. This concern is broader than asking whether a particular rule has desirable content. It includes the distribution of participation in rule formation, the visibility of affected relations, the possibility of institutional capture, the availability of alternative practices, and the capacity to revise a rule when its consequences or surrounding conditions change. Ostrom's work on institutional diversity is relevant because it directs attention to heterogeneous rule systems and situated processes of institutional development rather than assuming one universally adequate institutional form [19].

The governance argument in Section 12 proposed a distinction between central substantive norm-setting and central coordination of relational conditions. A coordinating institution can maintain common infrastructure, interoperability, information standards, appeal routes, and anti-capture protections while leaving substantial room for distributed norm formation. This distinction should not be interpreted as a norm-free model of governance. Protecting participation, contestability, or interoperability already expresses normative commitments. The more limited point is that higher-level governance can sometimes operate through conditions of normogenesis rather than through a complete substantive ordering of heterogeneous values.

The problem becomes especially difficult because the conditions of normogenesis are themselves historically generated. Existing property relations, legal standing, technical infrastructures, ecological constraints, educational systems, and inherited classifications shape who can participate in creating later norms. A formally open process can therefore reproduce accumulated asymmetries. Conversely, a central intervention designed to correct an asymmetry can introduce new dependencies or suppress local knowledge. The framework does not provide a general rule for resolving this tension. It makes the tension explicit by locating governance and normogenesis within the same evolving relational history.

This reflexive structure also limits any attempt to derive a fixed substantive *nomos* directly from GR. Section 11 treated normative judgment as historically and materially mediated, while Section 9 preserved disagreement among established evaluative traditions. A GR discussion of normogenesis can therefore describe how normative judgments enter and transform relational histories without claiming that historical emergence itself supplies a final criterion of justice.

15.4 Relational Consequences of Common Equivalence

Common equivalence is one of the most powerful coordination devices in heterogeneous conversion. Money permits heterogeneous goods, services, claims, and obligations to be denominated within a shared quantitative language. Currency markets extend this structure across monetary systems, while internationally central currencies can become vehicle currencies or reserve assets through which other monetary relations are mediated. Section 5 treated these structures as layered forms of equivalence rather than as evidence of intrinsic monetary value.

The justice relevance of common equivalence lies partly in its generative effects. Once a common equivalent becomes widely used, subsequent contracts, accounting systems, reserves, pricing conventions, and risk-management practices can be organized around it. Desan's account of monetary institutions and Cohen's analysis of currency hierarchy both support attention to this institutional and political dimension [8, 7]. The common equivalent therefore participates in the future relational field in which later conversions occur.

This point can be stated without treating monetary centrality as intrinsically unjust. A widely accepted currency can lower conversion costs, deepen liquidity, and support coordination across large networks. The same centrality can concentrate exposure to particular legal jurisdictions, financial infrastructures, policy changes, or geopolitical relations. International monetary use can therefore create both coordination benefits and relational dependencies. The relevant evaluative questions concern the distribution of these benefits and dependencies, the availability of alternatives, and the incidence of adjustment when relational conditions change.

The same structure appears outside money. Standardized credentials, legal classifications, accounting categories, carbon metrics, rankings, and technical standards can function as partial common equivalents for specific institutional purposes. They make heterogeneous entities comparable by selecting a common dimension. Their practical usefulness depends precisely on this reduction. Justice questions emerge when the metric extends beyond the domain for which its simplification is defensible, when control over the metric is concentrated, or when the metric reshapes the behavior it was initially introduced to measure.

Common equivalence therefore has a dual analytical status in the present framework. It is an infrastructure of coordination and a generator of subsequent relations. This dual status reinforces the central

claim of the paper: evaluation of heterogeneous conversion can require attention to the history and consequences of the conversion architecture in addition to the immediate equivalence relation it produces.

15.5 Research Problems in Conversion Justice

The preceding synthesis leaves several unresolved problems that should remain explicit. Table 14 summarizes seven open questions and the part of the framework they challenge.

The first open problem concerns relational scope. A fully relational ontology can make almost every present value dependent on a very large historical background. Practical justice analysis therefore requires finite identification without pretending that the selected boundary is metaphysically complete. Section 4 treated this as an epistemic problem; future work must also determine how different normative theories justify different boundaries of relevance.

The second concerns co-generation and attribution. The paper has distinguished legal holders, generative participants, experiential bearers, decision authorities, and affected relations, but it has not supplied a universal rule for translating these positions into distributive claims. Such a rule would already constitute a substantive theory of justice. The integrative framework is intended to make this choice visible rather than to conceal it inside the conversion metric.

The third and fourth problems concern commensurability and normogenesis. Partial commensurability allows practical comparison while preserving unresolved dimensions of value, yet institutions still require criteria for deciding when a common metric is adequate. Likewise, emergent nomos can be described historically while its justification remains contested. These problems suggest that the next stage of the research programme should combine formal representation with closer engagement with domain-specific practices of justification, contestation, and repair.

The final group concerns intervention and evidence. Irreversible conversions require analysis of repair pathways; cross-scale systems require a functional account of coordination; and empirical applications require observable indicators rather than purely conceptual variables. The framework therefore remains a discussion architecture rather than a predictive model. Its principal contribution is to separate questions that are easily collapsed when heterogeneous conversion is represented only by a price or ratio, and to provide a common language in which those questions can be studied without requiring their normative answers to be identical.

Table 14: Open questions for research on heterogeneous conversion justice. The questions identify unresolved theoretical and empirical tasks rather than deficiencies presumed to have one universal solution.

Problem	Open question	Framework implication
Relational identification	How much history and surrounding structure should count as part of the entity relevant to a conversion?	Entity identification requires bounded, contestable scope rather than unlimited relational ancestry.
Attribution under co-generation	How should claims be attributed when value emerges through overlapping human, institutional, technical, and ecological relations?	Attribution cannot be assumed to coincide with legal ownership or visible production.
Partial commensurability	Under which covering considerations is a common metric adequate, and where should comparison remain incomplete?	Practical commensuration requires explicit scope conditions.
Normogenesis and critique	How can emergent conversion nomos remain open to criticism when evaluative standards are themselves historically situated?	Genealogy and justification must remain distinguishable without assuming a view from nowhere.
Irreversibility and repair	Which conversions require reversibility, staged commitment, compensation, restitution, or other forms of repair?	Post-conversion justice depends on feasible recovery histories as well as initial settlement.
Cross-scale governance	Which conversion functions are appropriately local, distributed, centralized, or coordinated across levels?	Governance architecture must be analysed function by function rather than through a single centralization measure.
Empirical operationalization	Which relational, epistemic, procedural, and distributive variables can be observed reliably in real conversion systems?	The discussion framework requires domain-specific empirical models before supporting predictive or policy claims.

16 Conclusion

This paper has developed a discussion framework for heterogeneous value conversion and justice. Its role has been synthetic: to connect questions that are often examined separately in economics, political economy, philosophy of money, procedural theory, epistemic justice, capability analysis, relational equality, and institutional governance. The paper has not proposed a universal criterion for just conversion. Its objective has been to clarify where normative problems can arise when heterogeneous values are identified, rendered comparable, converted, settled, and carried into subsequent relational configurations.

The analysis began from a simple observation. A visible conversion such as a wage, exchange rate, compensation amount, or settlement ratio presents only a compressed surface of a larger relational history. Section 2 therefore distinguished heterogeneous value from complete commensurability and treated practical comparison as potentially partial, purpose-relative, and institutionally mediated. Section 3 then located conversion within relational histories involving subjects, holders, contributors, institutions, material conditions, and affected relations. This shift does not eliminate the usefulness of numerical exchange. It identifies additional structures that can become relevant when a conversion is evaluated normatively.

The epistemic argument developed in Section 4 added a prior layer. Conversion procedures rely on identification, classification, recognition, evidence, and attribution before a ratio or transfer can be evaluated. Finite institutional representations necessarily compress a larger historical and relational field. The justice significance of that compression depends on the evaluative theory and the practical consequences of omission, fragmentation, conflation, false connection, historical truncation, or scale mismatch. Epistemic justice therefore appears in the framework as one possible dimension of conversion justice, particularly where representational practices affect standing, compensation, credibility, attribution, or

access to review.

The monetary discussion in Section 5 illustrated how common equivalence can coordinate heterogeneous values while also generating new relational dependencies. Money enables denomination and exchange across otherwise different goods, services, claims, and obligations. International monetary systems introduce an additional layer in which currencies themselves are converted and hierarchically positioned. The analysis treated currency value, convertibility, and stability as relationally and historically situated rather than as fixed intrinsic properties. This perspective also clarifies why identical nominal amounts can have different practical and normative significance across places, periods, institutions, and currency regimes.

Sections 6 and 7 extended the analysis from outcomes to the architecture of conversion. Conversion nomos was treated as historically generated through repeated practice, institutionalization, power, contestation, and revision. Procedural analysis then located justice questions in recognition, participation, information, bargaining conditions, settlement, revision, and the ordering of conversion-related operations. The paper preserved a distinction between descriptive stabilization and normative justification: a rule can become effective and durable without thereby becoming justified. Likewise, order sensitivity and noncommutative composition can make procedural histories structurally different without determining which history is normatively preferable.

The downstream analysis in Section 8 showed why settlement does not close the normative inquiry. Benefits and burdens can be redistributed through conversion costs, risk incidence, dependency, exit capacity, future optionality, and changes in subsequent relational structure. Section 9 then compared several established normative perspectives without ranking them. Welfare, entitlement, Rawlsian, capability, exploitation, relational-equality, non-domination, procedural, epistemic, and value-pluralist approaches select different features of a conversion history as normatively salient. Section 10 used the GR framework to place these evaluations over a shared descriptive history while preserving their irreducible differences in entity identification, evaluative dimensions, baselines, priorities, commensurability assumptions, and justificatory sources.

The treatment of emergent normativity in Section 11 added a reflexive dimension. Normative judgments arise within historically and materially mediated relational configurations and can themselves influence subsequent evolution. Nature, technology, infrastructure, institutions, symbolic systems, and contingency can therefore mediate norm formation alongside interpersonal interaction. Section 12 translated this insight into a governance problem. Distributed normogenesis can coexist with coordinating institutions whose functions concern access, information, interoperability, recognition, anti-capture conditions, contestability, revision, and cross-scale coordination. The framework therefore permits analysis of central coordination without treating a central node as the unique source of substantive nomos.

The illustrative cases in Section 13 and the limiting conditions in Section 14 reinforce a common conclusion. Heterogeneous conversion is often practically necessary, yet practical convertibility does not imply ontological reduction, complete epistemic access, full commensurability, reversibility, or normative determinacy. A labor contract, currency conversion, environmental compensation scheme, knowledge-attribution process, or retrospective claim can each be institutionally functional while leaving unresolved questions about what was represented, what was omitted, how risks and dependencies were distributed, and which normative theory should govern evaluation.

The paper's principal proposal is therefore methodological. Conversion justice can be studied through a layered architecture that distinguishes relational constitution, epistemic identification, commensuration, procedural ordering, conversion nomos, power over interfaces, distributive and relational consequences, theory-relative evaluation, and subsequent normogenesis. These layers are analytically connected without being reduced to one another. The framework is intended to support comparison across domains and theories while keeping the strength of each claim proportional to the evidence and assumptions available.

Several tasks remain open. Relational identification requires defensible boundaries that avoid both atomistic simplification and unbounded historical ancestry. Co-generated value requires attribution principles whose normative status cannot be inferred from causal contribution alone. Partial commensurabil-

ity requires criteria for determining which dimensions may legitimately be standardized for a given institutional purpose. Irreversible conversion requires more developed accounts of repair, restitution, staged commitment, and recovery. Cross-scale governance requires empirical study of which functions benefit from local autonomy, distributed coordination, or centralized infrastructure. Finally, the conceptual variables proposed here require domain-specific operationalization before they can support predictive, comparative, or policy claims.

Within these limits, heterogeneous value conversion provides a productive site for connecting economic, political, epistemic, and normative inquiry. The visible expression $A \rightsquigarrow B$ can remain useful, provided that its compression is made explicit when justice questions require a wider field of analysis. The present discussion therefore treats conversion neither as a purely technical transformation nor as a problem with a single universal moral solution. It treats conversion as a historically situated relational process whose epistemic construction, institutional architecture, normative evaluation, and downstream consequences can be examined within a common but pluralistic analytical language.

DRAFT

A Notation Reference

This appendix consolidates the principal symbols used in the discussion paper. The notation remains deliberately lightweight: several objects are theory-relative or application-relative, and the symbols identify analytical roles rather than a claim that one mathematical representation exhausts heterogeneous conversion. Table 15 summarizes the shared conversion vocabulary, while Table 16 summarizes the theory-relative and governance vocabulary.

DRAFT

Table 15: Core notation for heterogeneous conversion.

Symbol	Meaning	Analytical role
Ω	space of modeled relational configurations	domain for relational states used throughout the paper
ω_Σ	relational configuration at slice Σ	state on which identification, conversion, judgment, or governance can act
H_C	instantiated conversion history	conversion process together with the relevant initial configuration
$\mathcal{H}_C$	class of admissible conversion histories	domain for theory-relative identification and evaluation
$\mathfrak{N}_\Sigma$	effective conversion nomos at Σ	historically effective normative-institutional structure governing conversion
nom	nomos readout $\Omega \rightarrow \mathcal{N}$	identifies the effective nomos represented in a modeled configuration
$\mathcal{I}_a^{(c)}$	entity-identification map	constructs the relational entity relevant to focal referent a under context c
$\hat{E}_a^{(c)}$	identified relational entity	finite, context-dependent representation used in conversion or evaluation
$\alpha^{(c)}$	attribution map	assigns an attribution structure to an identified entity
Φ	state-changing transformation	represents recognition, conversion, judgment, governance, or another configuration-changing operation

Table 16: Theory-relative, procedural, and governance notation.

Symbol	Meaning	Analytical role
T	normative perspective	indexes theory-relative identification and evaluation
$\mathcal{I}_T$	theory-relative identification map	selects the entities or relational structures treated as normatively relevant by T
$\mathcal{E}_T$	theory-relative evaluation map	maps an instantiated conversion history and identified material into evaluative space E_T
$e_T(H_C)$	evaluative output under T	records the theory-relative assessment without presuming a common cardinal justice scale
$\mathcal{J}_T$	judgment-generation map	links an evaluative result to a practically instantiated judgment transformation
$\Phi_{J,T}$	judgment-induced transformation	represents a judgment that changes the subsequent relational configuration
$P_T(H_C)$	procedural profile	collects recognition, standing, information, bargaining, settlement, and revisability dimensions
$\mathcal{Q}(H_C)$	post-settlement revision set	represents procedurally admissible review or revision after settlement
$\mathcal{X}(a \mid \omega)$	exit set	collects admissible alternative conversion paths available to actor or position a
$\mathcal{O}_C(a)$	post-conversion option set	records accessible continuations after conversion
$\mathbf{k}_C(\omega)$	conversion-interface condition profile	summarizes access, information, interoperability, contestability, and revision conditions for governance analysis

References

- [1] Elizabeth S. Anderson. What is the point of equality? *Ethics*, 109(2):287–337, 1999. doi:10.1086/233897.
- [2] Henrik Andersson and Nien-hê Hsieh. Incommensurable values. In Edward N. Zalta and Uri Nodelman, editors, *The Stanford Encyclopedia of Philosophy*, Fall 2025 edition. Metaphysics Research Lab, Stanford University, 2025. Stanford Encyclopedia of Philosophy.
- [3] Serkan Arslanalp, Barry J. Eichengreen, and Chima Simpson-Bell. Gold as international reserves: a barbarous relic no more? IMF Working Paper 2023/014, 2023. doi:10.5089/9798400229947.001.
- [4] W. Brian Arthur. *Complexity and the Economy*. Oxford University Press, New York, 2015.
- [5] Geoffrey C. Bowker and Susan Leigh Star. *Sorting Things Out: Classification and Its Consequences*. MIT Press, Cambridge, MA, 1999.
- [6] Emanuela Ceva. *Interactive Justice: A Proceduralist Approach to Value Conflict in Politics*. Routledge, Abingdon, 2016.
- [7] Benjamin J. Cohen. *Currency Power: Understanding Monetary Rivalry*. Princeton University Press, Princeton, NJ, 2015. doi:10.2307/j.ctt1wf4dgb.
- [8] Christine Desan. *Making Money: Coin, Currency, and the Coming of Capitalism*. Oxford University Press, Oxford, 2014. doi:10.1093/acprof:oso/9780198709572.001.0001.
- [9] European Central Bank. What is money? Updated 19 June 2024. ECB explainer.
- [10] Mustafa Emirbayer. Manifesto for a relational sociology. *American Journal of Sociology*, 103(2):281–317, 1997. doi:10.1086/231209.
- [11] Wendy Nelson Espeland and Mitchell L. Stevens. Commensuration as a social process. *Annual Review of Sociology*, 24:313–343, 1998. doi:10.1146/annurev.soc.24.1.313.
- [12] Miranda Fricker. *Epistemic Injustice: Power and the Ethics of Knowing*. Oxford University Press, Oxford, 2007. doi:10.1093/acprof:oso/9780198237907.001.0001.
- [13] Albert O. Hirschman. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Harvard University Press, Cambridge, MA, 1970.
- [14] Brad Hooker. Rule consequentialism. In Edward N. Zalta and Uri Nodelman, editors, *The Stanford Encyclopedia of Philosophy*, Spring 2023 edition. Metaphysics Research Lab, Stanford University, 2023. Stanford Encyclopedia of Philosophy.
- [15] Karl Marx. *Capital: A Critique of Political Economy, Volume 1*. Translated by Ben Fowkes. Penguin Books, London, 1976.
- [16] Patrick McGuire, Goetz von Peter, and Sonya Zhu. International finance through the lens of BIS statistics: the global reach of currencies. *BIS Quarterly Review*, June 2024. BIS publication.
- [17] Robert Nozick. *Anarchy, State, and Utopia*. Basic Books, New York, 1974.
- [18] Organisation for Economic Co-operation and Development. Purchasing power parities—frequently asked questions. Published 1 June 2024. OECD data explainer.
- [19] Elinor Ostrom. *Understanding Institutional Diversity*. Princeton University Press, Princeton, NJ, 2005. ISBN 9780691122076.

- [20] Philip Pettit. *Republicanism: A Theory of Freedom and Government*. Oxford University Press, Oxford, 1997.
- [21] John Rawls. *A Theory of Justice*. Revised edition. Belknap Press of Harvard University Press, Cambridge, MA, 1999. doi:10.2307/j.ctvkjb25m.
- [22] Ingrid Robeyns and Morten Fibieger Byskov. The capability approach. In Edward N. Zalta and Uri Nodelman, editors, *The Stanford Encyclopedia of Philosophy*, Summer 2025 edition. Metaphysics Research Lab, Stanford University, 2025. Stanford Encyclopedia of Philosophy.
- [23] Amartya Sen. *Commodities and Capabilities*. North-Holland, Amsterdam, 1985.
- [24] Matt Zwolinski, Benjamin Ferguson, and Alan Wertheimer. Exploitation. In Edward N. Zalta and Uri Nodelman, editors, *The Stanford Encyclopedia of Philosophy*, Fall 2026 edition. Metaphysics Research Lab, Stanford University, 2026. Stanford Encyclopedia of Philosophy.