

Reinterpreting Social Contract and Its Limitations under Generative Relational Nomos Formation

A Preliminary 2-Complex and Operator-Algebra-Inspired Formalization

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Abstract

This paper develops a preliminary Generative Relational reconstruction of social-contract reasoning and uses it to re-explain recurring limitations concerning contract-formative capacity, nonhuman subjects, and cross-border normative coordination. Contract formation is situated within prior processes of relational manifestation, symbolic distinction, and nomos formation. A GR subject is represented at the relational-formal level through an extended history-bearing structure for which a 2-complex supplies one convenient realization; operator-algebra-inspired language is introduced only where composition or field-like efficacy requires it. The analysis distinguishes potential generative horizons from their effective restriction under actual conditions, separates generative constraint from a nomos-relative contract-formative gap, treats cross-species difficulty as a problem of cross-nomic manifestation and typing, and treats cross-border difficulty as a problem of inter-nomic mediation. These mechanisms share dependence on historically generated nomoi while remaining formally non-reducible. The reconstruction is diagnostic and model-relative: structural difference alone supplies neither a universal theory of justice nor a claim about ultimate ontology.

Keywords: social contract; nomos formation; Generative Relational theory; 2-complex; contractual limitations

Discussion Paper Note

This manuscript is a preliminary formal and interpretive study of social-contract theory within the wider Generative Relational research programme. Its present objective is limited to reconstructing contract formation and explaining several recurring limitations identified in the social-contract literature. The paper does not yet develop a general ethics for heterogeneous relational subjects, including human–AI, AI–AI, human–animal, or possible future human–nonhuman relations. Those questions require additional normative argument and are reserved for subsequent work.

The formal language used in this manuscript is representational. A 2-complex is employed as one model for relationally extended subjects and histories; operator-algebra-inspired language is introduced only where it clarifies composition, transformation, or field-like effects. These devices do not settle the ultimate ontology of social or political reality.

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Status. This preliminary manuscript contains the complete argument developed in the present paper: literature reconstruction, established limitation review, Generative Relational foundations, the general contract model, three limitation analyses, comparative synthesis, scope and limitations, and conclusion. The manuscript remains subject to revision.

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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 website 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.

DRAFT

1 Introduction

Social-contract theory comprises a family of justificatory approaches whose accounts of parties, agreement, reasons, and normative authority differ substantially. In much modern and contemporary work, the contract functions less as a report of a literal founding transaction than as a structured test of whether principles or institutions can be justified to suitably represented parties under specified conditions [8, 23]. This paper therefore treats social contract as a mode of normative construction whose operation depends on how parties are represented, which reasons and forms of agreement are admissible, and which background relations make the procedure intelligible.

The same architecture has generated recurring difficulties at its boundaries. Nussbaum's *Frontiers of Justice* organizes three prominent problems around disability, nationality, and species membership, especially where contractarian models begin from roughly comparable capacities or reciprocal advantage [21]. Disability and childhood raise questions about dependency, developing or heterogeneous capacities, support, and representation. Nationality raises questions about justice across differently constituted political communities. Species membership raises questions about nonhuman beings whose lives can be deeply affected by human normative orders while their modes of agency and relational organization are not naturally captured by paradigmatic human contracting. These cases are heterogeneous; the analytical task is to explain why contract-based justification encounters pressure at each frontier without reducing the pressures to one deficit located in the affected subject.

The proposed explanation places contract formation within a wider history of nomos formation. A contract does not arise between exhaustively given subjects in an empty normative background. Contract formation already depends on relational structures that make parties legible, stabilize symbolic distinctions, define recognizable forms of assent and representation, and specify which histories count as valid formation. These background structures are themselves historically generated and can later be modified by contracts, institutions, conventions, and contestation. The paper therefore treats the focal contract as one generative event or history within a recursively evolving nomic environment.

The Generative Relational framework provides the formal vocabulary for this reconstruction while maintaining ontological restraint. It distinguishes ontological reality, whose ultimate content remains suspended; relational reality, which concerns sufficiently persistent and causally or generatively efficacious relational structures; and manifestation reality, which concerns the context-dependent presentations through which those structures become legible to an observer, language, institution, or nomos. A GR subject is represented at the relational-formal level as an extended relational history or spacetime. A labelled 2-complex provides one convenient representation of that history, and a spin-foam construction supplies a richer instantiation where additional labels and local compositional structure are useful. Operator-algebra-inspired language is employed only where transformation, composition, or field-like effects require it.

Within this architecture, three different limitation mechanisms become available. The first concerns contract-formative capacity and constraint: a subject-system has a potential generative horizon, an effective horizon under actual conditions, and a relation to the histories that a particular contractual nomos recognizes as sufficient for formation. The second concerns cross-nomic manifestation: a human symbolic and contractual nomos can require a translation or manifestation interface before its distinctions are meaningfully applicable to a heterogeneous nonhuman relational subject. The third concerns inter-nomic mediation: two political or legal systems can each support sophisticated local contract formation while lacking a pre-given shared interface for cross-border formation and recognition. These mechanisms can coexist, yet their formal loci differ.

The paper combines interpretive literature review with structural formalization. The literature review first reconstructs major social-contract traditions and then examines established discussions of disability, childhood, species membership, and justice across political boundaries. The formal sections introduce only those GR objects required to reorganize these difficulties: relational subjects, manifestation maps, historically emergent nomoi, generative horizons, contract-formative history families, contract-supported fields, and inter-nomic interfaces. The resulting claims are diagnostic and model-relative.

They identify dependencies that can arise under specified assumptions; empirical prevalence, causal importance, and normative evaluation require additional evidence and premises.

The present paper stops at this explanatory task. It neither supplies a complete theory of justice nor selects one institutional response to the diagnosed limitations. Questions concerning the positive construction of shared ethical nomoi among heterogeneous subjects—including human–animal, human–AI, AI–AI, and possible future human–nonhuman relations—are reserved for subsequent work. The immediate objective is to reinterpret social contract within generative relational nomos formation and to show how familiar limitations become structurally distinguishable once participation, manifestation, generative horizon, and inter-nomic mediation are represented separately.

2 Social Contract Theory and Contractual Justification

The literature review begins by reconstructing the social-contract tradition at the level required for the later Generative Relational analysis. The objective is interpretive: to identify recurrent components of contractual justification while preserving substantive differences among classical and contemporary theories. The discussion moves from Hobbes, Locke, Rousseau, and Kant to contemporary contractarian and contractualist developments, then examines hypothetical agreement, represented parties, the object of agreement, and the background conditions of justification. A final comparative synthesis supplies the vocabulary used in the subsequent review of established limitations before the GR reconstruction is introduced.

2.1 Classical Contract Traditions

The recognizably modern social-contract tradition develops through a family of distinct projects with no single invariant doctrine. Hobbes, Locke, Rousseau, and Kant all use contractual reasoning to connect political order with the standing or reasoning of those subject to it, while differing substantially in their accounts of the pre-political condition, the parties, the content of agreement, and the normative work performed by the contract [8]. The shared vocabulary of contract therefore identifies a mode of justification more reliably than it identifies a single substantive political theory.

Hobbes uses the state of nature to frame the problem of political order under conditions in which no common authority can settle disputes or reliably secure cooperation. The laws of nature direct rational agents toward peace, and the establishment of sovereignty is represented through covenant and authorization among persons seeking security from the vulnerabilities of an unregulated condition [13, 18]. The resulting argument assigns a central justificatory role to the relation between the absence of common authority, the reasons agents have to seek peace, and the authority generated through covenant. Hobbesian contract reasoning therefore links the justification of sovereign authority to a specified baseline and to the reasons attributed to agents situated within that baseline.

Locke retains the state-of-nature device while giving natural freedom, equality, and pre-political rights a more restrictive role in the justification of government. Political society is formed through consent, and government receives powers for purposes connected to the protection of rights and the public good; the legitimacy of political rule is consequently constrained by ends that are not created by governmental will alone [19, 31]. Locke’s account also distinguishes the formation of political community from subsequent decisions concerning the form and exercise of government. Contractual consent therefore operates within a normative background that already contains natural-law constraints and rights-bearing persons.

Rousseau turns the contract problem toward the reconciliation of political authority with freedom under conditions of social interdependence. The social pact constitutes a political association in which citizens are related through the general will, and legitimate law is connected to the collective willing of the citizen body rather than to the private will of any individual ruler [26, 4]. Rousseau’s account thereby makes the transformation of persons into citizens and the constitution of a collective political subject central to contractual reasoning. The contract concerns both cooperation among antecedently

represented individuals and the form of association through which political freedom and common law become possible.

Kant gives the original contract a more explicitly justificatory status. The original contract functions as an idea of reason rather than an account of a historical founding event, and it functions as a criterion according to which public laws must be capable of arising from the united will of a people [17, 34]. Contract language consequently survives even where actual consent is not treated as the historical source of political obligation. This move is important for later contract theory because it separates the justificatory structure of agreement from the empirical occurrence of an agreement-producing event.

These differences already establish two distinctions required by the present paper. First, contractual reasoning can concern political authority, membership, freedom, rightful law, or the terms of association without assigning the same role to consent in each case. Second, the contract device can operate historically, hypothetically, or regulatively. The literature therefore supports a reconstruction of social contract that attends separately to the represented parties, the conditions of agreement, the object of agreement, and the normative conclusion attributed to agreement; the word *contract* alone does not sufficiently specify the theory [8].

2.2 Contractarian and Contractualist Developments

Contemporary literature often distinguishes a Hobbesian contractarian line from a Kantian contractualist line, while also recognizing substantial diversity within each family. The distinction is analytically useful for the present paper because it shows that agreement can derive justificatory force from different accounts of practical reason. It should not be read as an exhaustive historical taxonomy or as a claim that every theorist fits one category without remainder [7, 1].

Contractarian approaches characteristically seek to explain moral or political constraints through the reasons agents have to cooperate under conditions of interdependence, vulnerability, or mutual advantage. David Gauthier's *Morals by Agreement* develops a prominent contemporary version in which moral constraints are defended in relation to rational choice and the benefits available through cooperation [11, 7]. The contractarian problem is therefore closely tied to the specification of agents' interests, the baseline from which gains are assessed, and the bargaining or choice conditions under which agreement becomes rational.

Contractualist approaches give greater weight to justification to persons conceived as free and equal reason-givers. Scanlon's contractualism evaluates principles by asking whether they could be reasonably rejected as a basis for informed and unforced general agreement, with the justificatory relation among persons carrying independent moral significance [29, 1]. This architecture differs from a mutual-advantage bargain because the admissibility of a principle depends on the reasons persons can offer to one another in addition to, or independently of, the cooperative surplus available to self-interested bargainers.

Rawls occupies a central but distinctive position in this landscape. *A Theory of Justice* revives the contract device through the original position, in which representative parties select principles of justice under informational restrictions designed to model fair terms of choice [23, 8]. Rawls's later work places the problem of justification within the conditions of reasonable pluralism and asks how a political conception can be stably endorsed by citizens who hold different comprehensive doctrines [24]. The trajectory from the original position to political liberalism reinforces the importance of distinguishing the model parties who deliberate within a contractual construction from the actual citizens whose reasons are ultimately relevant to public justification.

The contractarian–contractualist distinction therefore changes the interpretation of later limitations without eliminating them. A limitation associated with unequal bargaining power has a different structure in a mutual-advantage account from a limitation associated with whether a principle can be justified to each person. The present paper will preserve that difference. Its later use of a common formal language concerns the architecture of contract formation and justification; it does not imply identity among the normative theories represented by that architecture.

2.3 Hypothetical Agreement and Represented Parties

The movement from actual consent toward hypothetical agreement changes the status of the parties to the contract. In many contemporary theories, the agents who deliberate within the model are constructed representatives whose informational access, motivations, and available reasons are specified for a justificatory purpose. The resulting agreement is relevant to actual persons only through an additional relation connecting the reasoning of the modeled parties to the reasons of those who live under the proposed principles or institutions [8].

Kant's original contract provides an early form of this separation because the contract functions as an idea of reason by which legislation is tested rather than as an empirical transaction whose historical occurrence creates right [34]. Rawls develops the separation more systematically. Parties in the original position do not represent the full psychological or social histories of particular citizens. The veil of ignorance withholds specified information so that the choice of principles is not determined by knowledge of one's particular social position, talents, or conception of the good [23]. The parties are therefore formal representatives within a deliberative construction, while the principles selected are intended to regulate the basic structure under which actual citizens live.

For the present reconstruction, a contractual theory requires at least two relations to be specified. One relation connects actual persons to the parties who represent them inside the model. A second relation connects the model agreement to the normative status of rules or institutions outside the model. Contemporary analyses of social contract make this structure explicit by distinguishing the model choosers, the deliberative setting, the object selected, and the actual persons whose reasons for endorsement are at issue [8]. The later GR reconstruction will revisit these relations through manifestation and nomos formation, but the distinction itself is already internal to contemporary contract theory.

Hypothetical agreement also changes the role of consent. An actual promise or private contract can create obligations partly through the performative act of undertaking them. A hypothetical social contract often performs a different task: it reveals or constructs reasons for endorsing principles under specified conditions. Contemporary contract theory therefore commonly treats agreement as a justificatory test rather than as a literal historical act of self-binding [8]. This shift broadens the range of possible contract theories while increasing the analytical importance of how the parties and conditions of agreement are modeled.

2.4 Contractual Justification and the Object of Agreement

Social-contract theories also differ in what the parties are taken to agree upon and in what the agreement is meant to establish. The object can include sovereign authority, political membership, constitutional arrangements, principles of justice, institutional rules, or interpersonal moral principles. The normative conclusion can concern legitimacy, political obligation, justice, moral rightness, or public justifiability. Contemporary literature therefore treats the object and justificatory function of agreement as distinct dimensions of a contract theory [8].

In Hobbes and Locke, contractual reasoning is centrally connected to political association and authority, although the theories disagree about the scope and limits of the resulting government [18, 31]. Rousseau places the constitution of the political association and the general will at the center of legitimate law [4]. Kant uses the original contract to test whether public legislation is consistent with a possible united will rather than to describe an originating transaction [34]. These variations show that the social contract can operate at different levels of political organization even within the classical tradition.

Contemporary theories widen the object further. Rawls's parties select principles for the basic structure of society; Gauthier employs agreement to ground moral constraints compatible with rational agency; Scanlon uses the idea of reasonable non-rejectability to characterize principles governing what persons owe to one another [23, 11, 29]. The common thread is therefore weaker than the claim that each theory derives obligation from consent. A more defensible commonality is that some specified relation of agreement, acceptability, or non-rejection contributes to the justification of norms for those to whom the norms apply [8].

This distinction between object and justificatory role is important for the later analysis of limitations. A theory can face a difficulty because some subjects are excluded from the modeled parties, because the object of agreement omits relations affecting them, because the agreement conditions translate their interests inadequately, or because the move from model agreement to normative justification is insufficiently explained. Treating these as separate questions allows the paper to examine recurring limitations without assuming in advance that they share one causal mechanism.

2.5 Background Conditions of Contract Formation

Contractual justification depends upon a background that determines what can count as a party, what information parties possess, which reasons they may use, what alternatives are available, and what follows if agreement fails. These conditions are not auxiliary details. They determine the deliberative problem from which the agreement is derived and can materially affect the content and justificatory significance of the resulting contract [8, 7].

The initial situation is one recurrent background component. Hobbes's state of nature supplies a baseline marked by insecurity and the absence of common authority; Locke's state of nature contains natural rights and law prior to political society; Rawls's original position specifies a fair choice situation under informational restrictions; Gauthier's bargaining framework models cooperative gains relative to a specified starting position [18, 31, 23, 11]. A contract can therefore be justified partly through comparison with a baseline whose structure has already been theoretically selected.

The description of parties supplies another component. Contract theories make assumptions about rationality, motivation, information, independence, equality, reciprocity, and the ability to understand or act upon the relevant reasons. These assumptions vary across theories and may be introduced for different purposes. In Rawls, restrictions on information are intended to model fairness in the choice of principles; in Hobbesian contractarian approaches, the description of interests and the possibility of cooperative gain help determine why agreement is rational; in Scanlonian contractualism, the relevant structure concerns reasons that persons can offer in justification to one another [8, 7, 1].

The background also contains a symbolic and institutional vocabulary, even where a theory does not formalize that vocabulary as an independent object. Terms such as person, citizen, consent, property, obligation, representation, cooperation, and public reason are already meaningful within the theoretical construction before the final agreement is reached. The present section makes no claim that these meanings have one common historical source. It records a more limited point: contractual reasoning requires sufficiently specified categories and relations for the parties, their reasons, and the object of agreement to be identifiable within the model. The later GR foundations section will ask how such categories can themselves be represented as historically generated relational structures.

The role of background conditions creates an important methodological requirement. Evaluation of a contract model also requires attention to the structure that precedes its endpoint. The construction also depends on how the initial situation is defined, which subjects are represented, what information and reasons are admitted, and which alternatives count as available. This observation is well established within the social-contract literature and provides the immediate bridge to the subsequent review of established limitations.

2.6 Social Contract Theory in Contemporary Literature

The contemporary literature supports a plural understanding of social contract rather than a single canonical formula. A widely used analytical reconstruction distinguishes the role assigned to the contract, the parties, the form of agreement, the object of agreement, and what agreement is supposed to establish [8]. The same literature also distinguishes bargaining-oriented contractarian approaches from justificatory contractualist approaches, while recognizing that Rawlsian, Gauthierian, Scanlonian, and other contemporary theories differ in the reasons attributed to parties and in the normative conclusions drawn from agreement [7, 1].

Table 1: Selected social-contract traditions and the analytical dimensions used in this paper.

Tradition	Parties or starting representation	Principal object	Role of agreement or acceptability
Hobbes	Individuals without a common political authority, motivated to secure peace and protection	Sovereign political order	Covenant and authorization connect rational reasons for peace to sovereign authority
Locke	Naturally free and equal rights-bearers under natural law	Political society and limited government	Consent forms political community and supports legitimate government within prior normative constraints
Rousseau	Individuals constituted through political association as citizens	Political association, law, and the general will	The social pact structures collective self-rule and the reconciliation of freedom with political authority
Kant	Rational citizens considered through the idea of an original contract	Rightful public legislation and civil condition	Possible united willing supplies a rational test for public law rather than an empirical founding event
Rawls	Representative parties in the original position under a veil of ignorance	Principles regulating the basic structure	Hypothetical agreement models fair justification of principles for free and equal citizens
Gauthier	Rational agents situated for cooperative choice	Moral constraints and cooperative terms	Agreement connects rational advantage with constraints on individual pursuit of interest
Scanlon	Persons whose individual reasons are considered under informed and unforced justification	Principles for interpersonal morality	Reasonable non-rejectability expresses mutual justification rather than bargaining for cooperative surplus

Table 1 summarizes the limited dimensions required for the present paper. The table is interpretive rather than exhaustive. Its purpose is to keep the later formalization from treating historically and philosophically distinct theories as instances of one substantive doctrine. The comparison identifies the starting representation of parties, the principal object of contractual reasoning, and the role assigned to agreement or acceptability.

The comparison in Table 1 supports a restrained working conception for the remainder of the paper. Social-contract reasoning will refer to a family of justificatory constructions in which represented parties are placed within specified conditions and some relation of agreement, acceptability, or non-rejection contributes to the normative assessment of rules, institutions, or principles governing persons beyond the model itself. This working conception is intentionally broader than any one tradition and narrower than the claim that every form of public justification is contractual.

The reconstruction also identifies where limitations can arise before a new formalism is introduced. Difficulties may concern the description of parties, the accessibility of the deliberative procedure, the representation of reasons and interests, the boundaries of the community to which justification is addressed, or the relation between modeled agreement and the subjects affected by the resulting norms. The subsequent section therefore turns to the established literature on disability and dependency, childhood and developing agency, species membership, and justice across political boundaries. The GR reconstruction begins only after those limitations and the principal existing responses have been stated on their own terms.

3 Contractual Limitations in the Existing Literature

The second literature-review stage examines the limitations that motivate the later Generative Relational reconstruction. Its objective is diagnostic: to present disability and dependency, childhood and developing agency, species membership, and justice across political boundaries on their established terms before introducing new formal vocabulary. The section then reviews representative contractarian and contractualist responses and isolates the structural questions retained for reconstruction. This ordering anchors the later GR analysis in difficulties already present in the literature and prevents the formalism from manufacturing its own target problems.

3.1 Disability, Dependency, and Unequal Contracting Parties

Disability provides one of the clearest challenges to contract models whose justificatory setting is built around parties with sufficiently comparable capacities for practical reasoning, cooperation, or reciprocal advantage. Nussbaum's *Frontiers of Justice* places disability among three problems that expose limits in contractarian constructions centered on mutual advantage among approximate equals [21]. Her criticism is directed especially at the relation between the description of the parties and the later scope of justice: persons with severe physical or cognitive disabilities can possess claims that justice must address even when the capacities attributed to model contractors do not describe their modes of agency, dependency, or participation well.

The disability literature broadens this concern beyond one interpretation of Rawls. Feminist philosophy of disability has questioned the use of independence, normal functioning, and reciprocal contribution as tacit standards for political and moral agency. It has also emphasized that dependency is not an exceptional relation external to ordinary social life. Infancy, illness, aging, care, and severe disability place persons within relationships whose asymmetries can be persistent or recurrent, and these relations affect both dependents and caregivers [30]. The resulting criticism concerns the theoretical starting point: a model built primarily around independent parties who bargain or reciprocate can represent some important social relations clearly while giving less direct treatment to relations in which care, support, representation, or dependency are constitutive features.

The difficulty becomes sharper in the case of severe cognitive disability. Beaudry characterizes the problem in terms of whether contractual moral and political thought can provide a compelling justification for the robust moral status of persons with severe intellectual disabilities, especially when the relevant persons cannot participate in contractualist procedures in the manner assumed by paradigmatic contractors [3]. This framing separates two questions that can otherwise be merged. One concerns whether a person can perform the reasoning or communicative acts represented inside the justificatory procedure. The other concerns whether the principles generated through that procedure apply to, protect, or recognize that person. The two questions need not receive the same answer.

Contractual theories have resources for responding to this difficulty, and the literature should not be represented as uniformly exclusionary. Freeman, for example, defends a Rawlsian contractarian approach in which trustees or guardians represent the interests of persons with severe and profound cognitive disabilities within an impartial justificatory construction [9]. Other proposals reconstruct the relevant basis of cooperation through trust, contribution, or forms of active and passive citizenship rather than through a narrow image of reciprocal productive exchange [3]. These responses show that the disability frontier is partly a dispute over how much the party-description can be revised while the justificatory structure remains recognizably contractual.

The established literature therefore supports a limited conclusion. Disability does not demonstrate that contractual reasoning is incapable of extension. It reveals pressure on theories in which the capacities used to model participation are closely connected to the status of being a recipient of justice. The later formal analysis will treat this pressure as a problem concerning contract-formative conditions, actual constraints, and the relation between a subject's possible forms of participation and the histories that a particular contractual nomos recognizes as sufficient.

3.2 Childhood and Developing Contractual Agency

Childhood is not one of Nussbaum's three named frontiers, but it provides a useful companion case for the disability problem because the relevant capacities are characteristically developmental and temporally variable. Contemporary work on childhood in liberal theory observes that children have often been treated differently as political and legal subjects because of assumptions concerning weakness, dependence, incomplete agency, and special need [6]. The issue is not exhausted by whether children possess agency in an all-or-nothing sense. Children can express preferences, form intentions, participate in decisions, and exercise increasingly complex forms of agency while remaining subject to legal and institutional structures that give adults special authority or representative roles.

Brando's reconstruction of childhood in liberal theory emphasizes a recurring tension between principles of basic equality and the differentiated status assigned to children. Historical and contemporary liberal theories frequently associate full participation with capacities such as rationality, cooperation, and consent, while children are understood to possess or exercise those capacities in developing forms [6]. Contemporary approaches respond in different ways, including gradual, differential, liberationist, and adaptive accounts of children's rights. These approaches disagree about when differences in agency justify differentiated rights and about how developmental, vulnerability, and dependency considerations should enter political evaluation.

For the present paper, childhood contributes an analytical distinction that will later be formalized. A condition relevant to contract formation can vary over the history of one and the same relational subject. A child who cannot perform a legally recognized contractual act at one stage can later acquire the capacities and standing required for that act. The difficulty therefore cannot be represented adequately by a permanent binary division between contractors and non-contractors. It concerns the relation among a developing subject, the conditions currently available for participation, and an institutional threshold that identifies some manifestations of agency as contract-formative while excluding others.

This temporal structure also helps distinguish capacity from constraint. A young person may possess some abilities relevant to understanding, expressing preference, or refusing an arrangement while lacking legal authorization or access to a recognized procedure. In another case, the relevant abilities themselves may still be developing. The literature on childhood consequently supplies a useful warning against treating contractual competence as a context-free scalar property. The later GR reconstruction will preserve the difference between a subject's potential generative horizon, the effective horizon available under present conditions, and the nomos-relative family of histories that counts as sufficient contract formation.

3.3 Species Membership and Nonhuman Subjects

Species membership raises a different limitation. Nussbaum's third frontier concerns whether nonhuman animals can enter the scope of justice when the governing theory begins from contractual relations among parties characterized through capacities and forms of reciprocity associated with human political agency [21]. The challenge is especially visible where direct participation in agreement, rational interaction, or reciprocal cooperation supplies the route through which moral standing is explained.

Contemporary contractarian and contractualist literature does not yield a single answer. The Stanford Encyclopedia's survey of contractarianism notes proposals under which contractors can agree to extend direct moral standing to animals, while also observing the resulting concern that the standing of beings unable to participate in the initial agreement may become contingent on the preferences or interests of contractors [7]. Rowlands argues that influential forms of Rawlsian contractarianism can be reconstructed so that animal claims are compatible with, and in his account supported by, the contractual method [28]. Roberts-Cady likewise argues that a Rawlsian framework can support protections for nonhuman animals when such protections can be justified through public reason [25]. These responses are significant because they show that exclusion of animals does not follow from the word *contract* alone.

The persistent difficulty concerns the relation between the justificatory device and the beings whose treatment is being evaluated. Some contract theories model the relevant parties through capacities for

reciprocal reasoning, agreement, or compliance. Many nonhuman animals do not participate in those procedures in the same symbolic and institutional forms as paradigmatic human contractors. The theory must therefore explain how their claims enter the justificatory construction: directly, through representation, through the interests of contractors, through an independently grounded moral principle, or through a revision of the contractual model itself. Different answers alter the source and stability of the resulting moral status.

This limitation should also be distinguished from the disability case. Treating the animal problem as a simple instance of lower rational capacity assumes in advance that the human contractual grammar supplies the correct scale on which the comparison should be made. The literature reviewed here establishes only that contract theories face a representation problem concerning beings who are affected by human normative orders but do not participate in contractual procedures in the paradigmatic human form. The later GR sections will examine the stronger possibility that the problem involves heterogeneous relational and symbolic structures, such that a human contract criterion may require a translation or manifestation interface before a comparison is even well formed.

3.4 Nationality and Justice across Political Boundaries

Nussbaum's nationality frontier concerns justice across national boundaries and should be distinguished from the narrower problem of private cross-border contracting. Her discussion asks whether contractarian strategies that begin from bounded political communities can adequately address global inequality, transnational obligation, and the claims of persons whose life prospects are affected by institutions and relations extending across states [21]. The analytical problem is therefore one of the scope and construction of the relevant justificatory community as much as one of agreement among individual parties.

Rawls's *The Law of Peoples* illustrates one influential contract-based response. At the international level, Rawls constructs a second original position in which representatives of peoples, rather than representatives of all individuals in the world, select principles governing relations among political societies [22, 10]. The resulting law of peoples includes principles concerning independence, treaty observance, equality among peoples, non-intervention, human rights, restraints on war, and assistance to burdened societies. The architecture is deliberately international rather than a direct global extension of the domestic original position.

This move generated a substantial literature on the morally relevant unit and scope of justice. Cosmopolitan and institutional approaches argue that global economic and political interdependence can create structures sufficiently consequential to warrant principles of justice beyond the domestic basic structure, while other approaches assign normative significance to coercive political institutions, national membership, or particular forms of collective association [5]. The disagreement therefore concerns more than the amount of redistribution required. It also concerns which relational structure counts as the site to which principles of justice properly apply.

The nationality frontier is particularly important for the later GR analysis because it demonstrates a limitation that remains even when the relevant parties possess sophisticated contractual capacities. Two political communities can each contain well-developed legal systems, languages, institutions, and practices of agreement while differing in the background categories through which parties, authority, obligation, property, representation, and enforcement are understood. A cross-border normative relation may therefore require a mediating structure through which these meanings become mutually intelligible and institutionally effective. The problem is not reducible to individual incapacity. It concerns the relation between multiple established normative orders.

The literature on international justice already contains competing responses to this problem. Rawls models a society of peoples through a second contractual construction; cosmopolitan theories extend the relevant justificatory domain toward persons within a global institutional order; nationalist and statist approaches give greater weight to the moral significance of political association, coercion, or national community [5]. The present paper does not adjudicate among these positions. It uses their disagreement to motivate a formal distinction between contract formation within one established nomos and mediation

across heterogeneous nomic systems.

3.5 Existing Contractarian and Contractualist Responses

The limitations reviewed above have generated several families of response. Their differences matter because the subsequent GR formalization reinterprets the structure of problems that the literature has already addressed in substantive ways.

A first response expands representation within the contract. In disability theory, trustees or guardians can represent persons who do not directly perform the reasoning attributed to the model parties, and contractual principles can be selected with their needs and interests explicitly included [9]. Related proposals distinguish active participation from forms of passive citizenship or reconstruct contribution through trust and dependence rather than through reciprocal productive exchange [3]. These strategies preserve a contract-based justificatory architecture while revising who or what can be represented within it.

A second response revises the capacities or relations treated as relevant to participation. Disability scholarship has explored trust, care, supported participation, and collaborative accounts of agency; childhood scholarship has developed gradual and adaptive accounts rather than a single transition from incapacity to full autonomy [30, 6]. These approaches place pressure on any account that treats rational bargaining capacity as the sole form of politically relevant agency.

A third response extends the subject matter of contractual justification. Arguments concerning animals attempt to show that protections for nonhuman beings can be justified by contractors, incorporated into Rawlsian public reason, or derived from revised contractual assumptions [7, 28, 25]. These proposals differ over whether animal standing is direct, represented, or derivative, but they demonstrate that contractual methods can be modified to reach beyond the set of beings who themselves perform the modeled agreement.

A fourth response reconstructs the scale of the contract. Rawls's international original position treats peoples as the relevant parties, while cosmopolitan theories question whether national boundaries should determine the scope of distributive justice where global institutions and interdependence structure opportunities and burdens across borders [22, 5]. The disagreement illustrates that the boundary of a contractual community is itself a theoretical choice requiring justification.

These responses also show why the three limitation families should remain distinct. Representation can address some disability cases without resolving cross-species translation. Expanding the scope of justice across borders does not settle the conditions under which a child or severely cognitively disabled person can participate in contract formation. Extending animal protection through the preferences of contractors does not by itself explain the relation between heterogeneous normative systems. The literature therefore supplies multiple strategies directed at different points in the contractual architecture, with no single repair covering every limitation family.

3.6 Structural Questions Retained for Formal Reconstruction

The literature reviewed in this section identifies substantial difficulties and develops serious responses. The remaining task for this paper is narrower than supplying another substantive theory of justice. It asks whether a common structural language can locate these difficulties at different points within contract-based justification while preserving their distinct explanatory structures.

Four distinctions are especially important for that task. First, the capacity to participate in a contractual procedure can differ from the status of being affected by or protected under the norms generated through that procedure. Second, a subject can possess relevant abilities while actual institutional, communicative, legal, or material conditions prevent those abilities from being realized in a contract-formative history. Third, a symbolic or legal representation can make a subject legible to a contractual procedure while preserving only part of the relational structure relevant to that subject. Fourth, two established normative systems can each sustain contract formation internally while lacking a pre-given common interface through which a cross-system agreement becomes mutually intelligible and recognizable.

Table 2: Established limitation families, representative responses, and the structural questions carried into the GR reconstruction.

Limitation family	Established difficulty	Representative responses	Structural question retained for later analysis
Disability and dependency	Modeled parties can presuppose capacities, independence, or reciprocity that do not describe some persons' modes of participation	Trusteeship, guardianship, trust, supported participation, revised cooperation, capabilities	How should contract-formative conditions be distinguished from standing, constraint, and represented participation?
Childhood	Agency, authorization, and dependency vary across a developing history rather than across a fixed capable/incapable boundary	Gradual, differential, liberationist, and adaptive accounts of children's rights and agency	How can a contract model represent temporally changing generative capacity and institutional constraint?
Species membership	Human contractual procedures can govern beings that do not participate in the modeled agreement in paradigmatic human form	Indirect inclusion, revised Rawlsian arguments, public-reason protections, expanded contractarian accounts	When is a human contractual criterion a meaningful representation of a heterogeneous nonhuman relational subject?
Nationality and political boundaries	Justice must be specified across political communities whose institutions and memberships are not reducible to one domestic basic structure	Society of peoples, cosmopolitan extension, statist and nationalist accounts, global institutional approaches	How can heterogeneous normative orders generate or sustain a shared justificatory interface?

The reviewed literature contains elements of each distinction, but it does not by itself supply the particular formal synthesis pursued in the remainder of this paper. Disability and childhood literatures analyze dependency, representation, competence, and developing agency; animal-ethics literatures analyze the relation between contractual participation and moral standing; international-justice literatures analyze the scope of the justificatory community and the relation among peoples, states, individuals, and global institutions. The Generative Relational reconstruction will place these questions within a common architecture of relational subjects, manifestation, historically emergent nomos, generative horizons, and inter-nomic mediation. This is a formal reorganization of existing problems; it does not imply that the established literatures share one substantive theory.

Table 2 summarizes the literature-review stage before the GR formalism is introduced. The table separates each limitation family from representative responses and from the structural question that the later formal sections will investigate. The final column states a research question. No normative verdict follows from the table itself.

Table 2 provides the transition to the paper's constructive part. The next section will introduce the minimum Generative Relational vocabulary required to represent these questions without yet assigning them a common normative answer. The subsequent contract model will then be used to examine the three principal limitation structures separately: contract-formative capacity and constraint, cross-nomic manifestation, and inter-nomic mediation.

4 Generative Relational Foundations

The formal reconstruction requires a compact set of Generative Relational foundations before contract-specific objects can be defined. This section establishes that foundation by distinguishing ontological, relational, and manifestation reality; representing relational subjects through history-bearing 2-complexes; locating change, structure, constraint, and difference within the broader concept of generativity; introducing generative horizons; formalizing manifestation and symbolic distinction; specifying historically emergent nomos; and stating the temporal and operator-algebra-inspired conventions used later. The construction extends an earlier GR metamodel and a companion formalism for heterogeneous relational histories while preserving their ontological restraint [14, 15].

4.1 Ontological, Relational, and Manifestation Reality

The present formalism distinguishes three analytical senses in which the word *real* may be used. The distinction prevents a mathematically effective representation from being promoted silently into an ultimate metaphysical claim, while also avoiding the opposite reduction in which socially or symbolically constituted structures are treated as causally negligible merely because their ultimate ontology remains unsettled.

Definition 4.1 (Three reality strata). The present GR formalization distinguishes the following strata.

1. *Ontological reality* concerns what ultimately exists. Its content is suspended in the present framework.
2. *Relational reality* concerns sufficiently stable or persistent relational beings and structures that retain historical continuity and exercise causal or generative efficacy over some represented region of relational spacetime.
3. *Manifestation reality* concerns context-dependent manifested or epistemically accessible presentations through which relational structures become legible within a specified observational, linguistic, institutional, legal, or practical relation.

Definition 4.1 is a methodological distinction with deliberately limited metaphysical scope. Relational reality is the principal level at which this paper works. Selves, currencies, institutions, languages, contracts, and other socially constituted structures can be treated at this level when the model supplies a sufficiently stable history and a specified way in which the structure affects relational possibilities. Their relational efficacy does not establish that the categories through which they are represented exhaust ontological reality.

A manifestation has its own modeled status while remaining distinct from the relational structure that supports it. Let $\mathcal{R}$ denote a model-dependent family of relational objects and let X_c be the representation space associated with context c . A manifestation map has the type stated in Equation 1.

$$\mathfrak{M}_c : \mathcal{R} \rightarrow X_c. \quad (1)$$

Equation 1 permits manifestation to be partial because a context need not render every relational object legible. The output $\mathfrak{M}_c(\mathfrak{S})$ is the manifestation of a represented relational subject $\mathfrak{S}$ in context c . The map can be selective, many-to-one, institutionally constrained, or dependent on prior history. The later contract model uses this distinction because a contracting procedure ordinarily operates on contextually manifested parties, while much of their relational history remains outside the selected representation.

Table 3 summarizes the reality distinction together with the temporal architecture introduced later in Subsection 4.7. The two axes are independent: the reality distinction concerns the status of represented objects, while the temporal distinction concerns how relational histories are ordered and sliced.

Table 3: Orthogonal analytical axes used in the GR formalism.

Axis	Layer	Working interpretation
Reality	Ontological reality	Ultimate ontology; deliberately suspended in the present formalism
Reality	Relational reality	Persistent and generatively efficacious relational structures represented by the model
Reality	Manifestation reality	Context-dependent representations, identifications, and symbolic or institutional presentations
Temporal	T_0 : temporal suspension	Relational event structure before commitment to a fundamental past–present–future ontology
Temporal	T_1 : generative ordering	Model-relative precedence or dependence among events
Temporal	T_2 : relational slicing	Conservative decomposition into accumulated history, active boundary, and possible continuation
Temporal	T_3 : epistemic temporal representation	Context-dependent reconstruction of temporal structure by an observing or institutional system

4.2 Relational Subjects and 2-Complex Representation

The GR subject used in this paper is temporally and relationally extended. At the relational-formal level, a subject is represented by a history-bearing spacetime-like structure whose identity extends beyond any fixed list of pointwise attributes. A labelled 2-complex supplies one convenient representation because it can retain events, pairwise relations, higher-order relational cells, branching, and historically extended attachment structure within one object.

For the present paper, write a labelled 2-complex schematically as Equation 2.

$$\mathcal{K} = (V, E, F, \partial, \ell), \quad (2)$$

where V is a vertex set, E an edge set, F a face set, ∂ records the relevant incidence or attachment data, and ℓ collects application-specific labels. The interpretation of cells is model-dependent. Vertices can represent events, edges can represent directed relations or process segments, and faces can represent higher-order relational histories or joint structures whose information would be lost under a purely pairwise graph representation.

Definition 4.2 (Subject representation). A *relational subject representation* consists of a history-bearing labelled complex $\mathcal{K}_{\mathfrak{S}}$ together with the event-order, boundary, manifestation, and operational structures required to track the represented subject $\mathfrak{S}$. These structures record persistence and generative efficacy at the resolution selected by the application.

Definition 4.2 does not identify the relational subject with one unique complex. Different resolutions can represent the same relational subject differently, and different epistemic contexts can expose different subcomplexes or labels. The subject-spacetime language therefore names the relational-historical mode of representation, while the chosen 2-complex supplies one formal realization of that mode.

Spin-foam constructions provide a richer instantiation of a 2-complex when representation labels and intertwiners or analogous local compositional data are analytically useful. In standard mathematical-physics usage, spin foams are labelled 2-complexes interpreted as histories between spin-network boundary states [2, 27]. The present GR formalism can instantiate a relational subject through a structure of the schematic form stated in Equation 3.

$$\mathfrak{F}_{\mathfrak{S}} = (\mathcal{K}_{\mathfrak{S}}, \{\rho_f\}_{f \in F}, \{\iota_e\}_{e \in E}). \quad (3)$$

Equation 3 is a mathematical instantiation of the relational spacetime representation. It does not assert that social subjects are quantum-gravitational systems or that the labels carry the physical interpretation assigned to spin-foam variables in quantum gravity. The formal value of the construction lies in its capacity to represent history, boundaries, local composition, and higher-order relational structure within one complex [15].

4.3 Generativity, Change, Structure, Constraint, and Difference

The term *generativity* is used in this paper in a broad GR sense. It concerns the relational-dynamical constitution through which a system can change, compose changes, encounter or generate constraints, preserve or collapse distinctions, and acquire new reachable histories under richer instantiations. The earlier GR metamodel isolates four prerequisites for such an account—change, structure, constraint, and difference—without claiming that these four axioms already constitute a complete theory of emergence [14].

At the highest abstract layer, let S be a carrier, M a semigroup of mechanisms, $\alpha : M \times S \rightarrow S$ an action, and $\sim$ a congruence respected by that action. The collapse associated with $m \in M$ is recalled in Equation 4.

$$\Delta(m) = \{(x, y) \in S \times S : x \not\sim y \wedge \alpha(m, x) \sim \alpha(m, y)\}. \quad (4)$$

Equation 4 represents difference through lost discrimination and therefore requires neither a metric nor an arithmetic remainder. The four metamodel roles can therefore be read as follows: change records that mechanisms act; structure records how acts compose; constraint records which distinctions or relations the system preserves; and difference records distinctions that a mechanism collapses. Later GR instantiations add event histories, partial admissibility, manifestations, nomos, and the possibility that the relevant discrimination structure itself changes historically.

Remark 4.3 (Generativity and novelty). Generativity is broader than the production of novel objects. Novelty can be one consequence of a generative history, while the concept also includes persistence, composition, constraint, loss of distinctions, opening and closure of possibilities, and changes in the rules under which later transformations become available.

Remark 4.3 is important for the later analysis of contract-formative capacity. A subject can possess substantial generativity even when a particular nomos does not recognize any currently available history as sufficient for contract formation. The relevant comparison therefore concerns the relation between the subject’s generative horizon and a nomos-defined contractual criterion; it supplies no global scalar ranking of generativity.

4.4 Generative Horizons and Relational Possibility

Contract formation requires a formal object for what a relational system could generate under suitable conditions. A conventional phase space would supply a global space of possible states in advance, but such a construction would reintroduce assumptions that the highest GR layer deliberately leaves open. The present paper therefore uses a history-relative *generative horizon*.

Fix a relational slice Σ under the conservative temporal representation introduced later in Subsection 4.7. Let $\mathcal{K}_{\leq \Sigma}$ denote the realized complex accumulated to that slice, and let $\mathcal{C}^*$ be a specified family of admissible condition profiles. A potential generative horizon is defined in Equation 5.

$$\mathfrak{H}_{\mathfrak{A}}^{\text{pot}}(\Sigma; \mathcal{C}^*) = \left\{ \mathcal{K}^+ \mid \begin{array}{l} \mathcal{K}_{\leq \Sigma} \hookrightarrow \mathcal{K}^+, \\ \mathcal{K}^+ \text{ is generatively realizable under some } c \in \mathcal{C}^* \end{array} \right\}. \quad (5)$$

Equation 5 treats the horizon as a family of admissible historical extensions and does not impose the structure of a homogeneous vector space. The symbol $\mathfrak{A}$ denotes the generative architecture supplied by the selected GR model; $\mathfrak{G}_{\leq \Sigma}$ is reserved below for accumulated relational history. The condition

family $\mathcal{C}^*$ is part of the analytical specification: changing which environmental, institutional, linguistic, technical, or support conditions are treated as available can change the potential horizon.

Assume that the actual condition profile c_Σ belongs to the analytical condition family $\mathcal{C}^*$. The effective generative horizon under that profile is stated in Equation 6.

$$\mathfrak{H}_\Sigma^{\text{eff}}(\Sigma; c_\Sigma) = \{ \mathcal{K}^+ \in \mathfrak{H}_\Sigma^{\text{pot}}(\Sigma; \mathcal{C}^*) : \mathcal{K}^+ \text{ is realizable under } c_\Sigma \}. \quad (6)$$

Equation 6 gives the structural distinction later used to separate capacity from constraint. A history can belong to the potential horizon while remaining absent from the effective horizon because the current relational configuration blocks its realization. The distinction remains model-relative and does not assign normative significance by itself.

Caution 4.4 (Horizon and temporal ontology). The notation $\mathcal{K}^+$ is tied to the conservative temporal instantiation used in the present paper. A temporally more neutral GR formulation can replace future extension by a family of globally admissible complexes or relational completions. The concept of generative horizon therefore does not require a fundamental metaphysics of an open future.

Caution 4.4 preserves the separation between the analytical convenience of future-directed reachability and the framework's suspension of stronger claims about fundamental time.

4.5 Manifestation and Symbolic Distinction

Manifestation becomes especially important when a relational subject enters a linguistic, legal, administrative, or contractual process. Such processes operate through finite distinctions. A symbolic system can therefore be represented partly through the equivalence relation induced by its manifestation map.

Let L denote a symbolic or linguistic context and let $\mathfrak{M}_L : \mathcal{R} \rightarrow X_L$ be the corresponding manifestation map. On its domain, define the induced symbolic equivalence relation by Equation 7.

$$x \sim_L y \iff \mathfrak{M}_L(x) = \mathfrak{M}_L(y). \quad (7)$$

Equation 7 gives a quotient-like representation of symbolic distinction. Two relational objects that remain distinguishable under a richer relational description can become equivalent under L because the symbolic context does not preserve the difference relevant to that richer description.

To record this loss explicitly, let $\sim_R$ denote an equivalence or indiscernibility relation supplied by the relational model used for comparison; $x \not\sim_R y$ then records that the selected model distinguishes x and y . The manifestation-collapse set is defined in Equation 8.

$$\Delta_L(\mathfrak{M}_L) = \{ (x, y) : x \not\sim_R y \wedge \mathfrak{M}_L(x) = \mathfrak{M}_L(y) \}. \quad (8)$$

Equation 8 is diagnostic. A nonempty collapse set does not establish error or injustice; finite symbolic systems commonly suppress distinctions that fall outside their operative resolution. Its analytical value lies in making the selection visible so that later sections can ask whether the distinctions removed by a human contractual representation are relevant under another nomos or under the evaluative commitments of the human ethical system.

Symbolic representation can also be generative. Once a category, legal status, currency unit, institutional identity, or contractual term becomes stabilized, it can alter the domain of later operations and create histories that were previously unavailable. The same symbolic structure can therefore collapse some prior distinctions while generating new relational possibilities. This dual role is central to the later account of contractual grammar.

4.6 Emergent Nomos and Relational Efficacy

Nomos provides the link between historically generated symbolic-relational structures and later operational possibility. The present paper uses *nomos* for a relatively stabilized relational structure that conditions admissibility, recognition, classification, obligation, interpretation, or another rule-governed aspect

of later histories. A nomos belongs to relational reality when the model represents sufficient persistence and efficacy for it to shape subsequent relational possibilities.

Following the companion GR formalism, a relational configuration at slice Σ is represented by Equation 9 [15].

$$\omega_\Sigma = (\mathfrak{G}_{\leq \Sigma}, \mathcal{B}_\Sigma, \mathfrak{N}_\Sigma), \quad (9)$$

where $\mathfrak{G}_{\leq \Sigma}$ is the accumulated relational history represented by the model, $\mathcal{B}_\Sigma$ is the active relational boundary, and $\mathfrak{N}_\Sigma$ is the effective nomos. The three components are analytically distinct. A relation can remain recorded in history after leaving the active boundary, while a later nomic development can alter how the same historical relation is classified or what operations it supports.

The operational efficacy of nomos can be represented through admissibility. Let $\mathfrak{D}$ be a family of candidate partial transformations on the configuration space Ω . The nomos-conditioned admissible family is stated in Equation 10.

$$\mathfrak{D}_{\mathfrak{N}_\Sigma}^{\text{adm}}(\omega_\Sigma) = \{\Phi \in \mathfrak{D} : \text{Adm}_{\mathfrak{N}_\Sigma}(\Phi \mid \omega_\Sigma) = 1\}. \quad (10)$$

Equation 10 provides a minimal representation of relational efficacy: a nomos can change which operations are available from a configuration and can thereby change the effective generative horizon. Richer models may distinguish permission, obligation, sanction, institutional support, or degrees of accessibility. The binary form is sufficient for the contract reconstruction developed later.

The equivalence or indiscernibility relation associated with a symbolic nomos, such as $\sim_L$ in Equation 7, is treated here as a historically generated component of that nomos. A language, legal order, or contractual grammar can emerge through repeated relational histories, stabilize through institutional support, and then act back upon later histories by determining which manifestations become legible and which transformations become effective. This endogeneity is one reason the present paper places contract formation within prior nomos formation rather than treating contract as the first normative event.

Remark 4.5 (Emergence and justification). Historical emergence and relational efficacy do not establish normative justification. A nomos can become stable through endorsement, dependency, institutional reproduction, power asymmetry, material constraint, or combinations of these processes. Ethical or political evaluation requires an additional evaluative structure.

Remark 4.5 prevents descriptive normogenesis from becoming a naturalistic theory of legitimacy. This distinction becomes essential in the species-membership analysis, where a human symbolic nomos can be relationally effective without thereby supplying an ontologically universal or ethically sufficient representation of nonhuman relational worlds.

4.7 Temporal Representation and Historical Persistence

The present paper requires enough temporal structure to distinguish accumulated history, an active relational boundary, and unrealized continuations. GR nevertheless suspends the claim that past, present, and future are fundamental features of ontological reality. The temporal representation is therefore layered.

At level T_0 , the model contains a relational event complex without committing to an ultimate metaphysics of temporal passage. At level T_1 , the event set V can be supplied with a partial order $\preceq$ representing model-relative generative precedence. At level T_2 , selected antichains are used as relational slices Σ , allowing the model to distinguish an accumulated order ideal from later extensions. At level T_3 , an observer, institution, or symbolic system can possess only a manifestation of that temporal structure, so the epistemically reconstructed past or future need not coincide with the full represented relational history.

For the present social-contract analysis, the T_2 representation adopts a conservative Historical Persistence Convention. If $\Sigma \prec \Sigma'$ are successive relational slices, the accumulated history is extended according to Equation 11.

$$\mathfrak{G}_{\leq \Sigma'} = \iota_{\Sigma \Sigma'}(\mathfrak{G}_{\leq \Sigma}) \cup \Delta \mathfrak{G}_{\Sigma \rightarrow \Sigma'}. \quad (11)$$

Table 4: Levels of operator language used or left available by the present formalism.

Level	Formal structure	Analytical role
Compositional	Partial maps and sequential composition	Represents admissibility, order sensitivity, and state-changing histories without linear structure
Operator-inspired	State-dependent families $F_p : \Omega \rightarrow \text{PEnd}(\Omega)$	Represents context-dependent realization of nominally similar operations
Operator algebra	A specified algebra of operators on a suitable linear representation space	Permits algebraic addition, commutators, spectra, norms, or other constructions when their assumptions are justified

Equation 11 states that realized history is retained under later extension in the working model. Later events can generate new relations to earlier events, new classifications, new recognition, new legal effects, and new manifestations of past structure while the earlier realized event complex remains represented. The convention supports provenance and retrospective comparison and is not presented as a theorem about fundamental physical time [15].

Caution 4.6 (Temporal suspension). A later GR model may replace the conservative slicing used here with a global, block-like, retrocausal, or otherwise nonstandard temporal architecture. The formal claims of this paper should therefore be read relative to the stated temporal instantiation whenever they rely on the distinction among accumulated history, active boundary, and possible continuation.

Caution 4.6 keeps the temporal layer orthogonal to the three reality strata in Definition 4.1. Ontological suspension remains in force under either a conservative or a more aggressive temporal representation.

4.8 Operator-Algebra-Inspired Representation

The later contract formalism requires a language for operations that can be unavailable in some configurations, can depend on the configuration in which they occur, and can compose in an order-sensitive manner. Partial transformations provide the minimal structure. Let Ω be the configuration space used at the selected level of instantiation. A partial operation has the type stated in Equation 12.

$$\Phi : \Omega \rightharpoonup \Omega. \quad (12)$$

Equation 12 does not assume that Ω is linear or that Φ is a linear operator. Its domain records the configurations in which the operation is executable. This makes partial maps particularly useful for contractual standing, authorization, representation, recognition, and other procedures whose availability depends on prior relational history.

State dependence can be represented by an operation schema. Let $\text{PEnd}(\Omega)$ denote the family of partial endomorphisms of Ω . For an operation type p , a schema has the form stated in Equation 13.

$$F_p : \Omega \longrightarrow \text{PEnd}(\Omega), \quad \Phi_p^{[\omega]} = F_p(\omega). \quad (13)$$

Equation 13 allows the concrete operation associated with a label such as recognition, authorization, agreement, or revision to change with the configuration in which it is instantiated. A later operation can therefore differ because an earlier operation changed the relational state on which the later schema is evaluated.

The subtitle’s reference to operator algebra marks this compositional and state-dependent operator language together with the availability of stronger representations when additional structure is justified. Table 4 separates three levels that should remain distinct.

A genuine operator algebra requires additional linear and closure assumptions. The present paper does not infer those assumptions merely from compositional noncommutativity. Where a later representation supplies an appropriate linear space, an operator algebra can provide a useful computational realization; otherwise, partial composition remains the operative formal structure [15].

Field-like language is used with the same restraint. A distributed nomic, symbolic, or institutional effect can be represented through assignments over vertices, edges, faces, or other cells of a relational complex, and these assignments can select or parameterize local operators. Such a representation can express how a relationally real structure modifies possibilities across an extended subject-spacetime. The field terminology does not establish a physical field ontology.

The foundations developed in this section supply the objects required by the contract reconstruction that follows. Relational subjects possess history-bearing representations; manifestations make selected aspects of those subjects legible; symbolic distinctions can collapse and generate relations; nomos conditions later admissibility; generative horizons record possible histories relative to a specified model and condition family; temporal slicing provides a conservative working representation without fixing fundamental temporal ontology; and partial operators provide a typed language for contract-relevant transformations. The next section uses these objects to construct the general GR architecture of contract formation before the three established limitation families are re-examined.

5 Generative Relational Reconstruction of Contract Formation

With the GR foundations in place, the analysis can specify a common architecture of contract formation before examining its limitations. This section combines relational subjects, manifestation, nomos, generative horizons, temporal structure, and operator language into a contract-specific construction. It develops contractual manifestation, contractual grammar, nomos-recognized formation histories, persistence of a generated contract subject, contract-induced nomic fields, and the distinct participation, recognition, and effect domains. The purpose is to provide one typed formal architecture within which later limitations can be located without treating them as one phenomenon.

Figure 1 summarizes the dependency structure developed in the section. Relational subjects enter a contractual process through context-dependent manifestations; a symbolic and institutional nomos conditions the grammar of recognized contract formation; an admissible generative history can produce a relationally persistent contract subject; and the resulting contract can modify active relations and later generative possibilities. The diagram separates these roles so that later limitations can be located at different interfaces without collapsing them into one generic failure of consent.

5.1 Contractual Manifestation of Relational Subjects

Contract formation begins from relational subjects whose histories exceed the finite distinctions available to a particular contractual process. A legal, linguistic, administrative, or interpersonal procedure therefore acts through selected manifestations of those subjects. The distinction established in Subsection 4.1 is used here to separate the relational subject from the party-description through which the contract-formative process becomes possible.

Let $\mathfrak{S}_i \in \mathcal{R}$ be a relational subject and let $c_C(\omega_\Sigma)$ denote the manifestation context relevant to a candidate contract C at configuration ω_Σ . For compact notation, write $c_C = c_C(\omega_\Sigma)$ within a fixed configuration. The contractual manifestation of $\mathfrak{S}_i$ is defined by Equation 14 whenever the manifestation map is defined.

$$M_i^{(C)} = \mathfrak{M}_{c_C}(\mathfrak{S}_i), \quad \mathfrak{S}_i \in \text{Dom}(\mathfrak{M}_{c_C}). \quad (14)$$

Equation 14 records the object through which the subject becomes legible to the contractual procedure. Depending on the application, $M_i^{(C)}$ can include a legally recognized person, an authorized representative, a corporate role, a linguistic identity, a competence classification, or another context-specific presentation. The manifestation can preserve substantial information while remaining a selective representation of the relational subject.

For a finite ordered family of candidate parties $I_C = (i_1, \dots, i_n)$, the corresponding manifestation profile is stated in Equation 15.

$$\mathbf{M}_C(\omega_\Sigma) = (M_{i_1}^{(C)}, \dots, M_{i_n}^{(C)}). \quad (15)$$

Equation 15 is intentionally indexed by the relational configuration. A subject can be manifested differently after changes in standing, representation, language, institutional status, age, or another relation encoded in ω_Σ . The contract model therefore does not treat partyhood as a timeless label attached directly to the relational subject.

Remark 5.1 (Manifestation and partyhood). A subject can belong to relational reality while lacking a manifestation that the current contractual process recognizes as a party. Conversely, a contractual manifestation can remain institutionally effective while preserving only a restricted portion of the subject's relational history.

Remark 5.1 supplies the first distinction needed for the later limitation analyses. Failure to appear within the recognized party-description of a contract is a fact about manifestation and contractual legibility at the selected context. It does not by itself establish absence of relational subjecthood, ethical standing, or generativity.

5.2 Symbolic Nomos and Contractual Grammar

A manifestation becomes contractually meaningful only within a symbolic and institutional structure that specifies which distinctions, expressions, acts, and relations count for the procedure. The present paper represents this structure through an effective contractual nomos $\mathfrak{N}_C$, understood as a specialized part or application of the effective nomos $\mathfrak{N}_\Sigma$ in Equation 9. The contractual nomos can include linguistic distinctions, legal classifications, conventions of assent, rules of representation, conditions of authority, and procedures for recognition or registration.

The symbolic component inherits the quotient-like structure introduced in Equation 7. Let L_C denote the symbolic context through which contract-relevant manifestations are expressed. The induced equivalence relation $\sim_{L_C}$ records which represented differences the contractual language preserves and which it treats as equivalent. Because L_C is historically supported by a nomos, the relation $\sim_{L_C}$ is itself part of relational reality at the level of the model rather than an externally given partition of ontological reality.

The paper uses the term *contractual grammar* for the nomos-conditioned structure that determines how manifested parties and contract-relevant operations can form recognized histories. The grammar is represented schematically in Definition 5.2.

Definition 5.2 (Contractual grammar). For a contract context C at configuration ω_Σ , let $\mathcal{G}_C(\mathfrak{N}_C, \omega_\Sigma)$ denote the corresponding *contractual grammar*. It is the model-specified structure containing the symbolic distinctions, party-identification conditions, operation types, admissibility conditions, and recognition rules used by $\mathfrak{N}_C$ to determine whether a relational history counts as formation of a contract of type C .

Definition 5.2 is deliberately broader than a syntax. A contractual grammar can include procedural, institutional, or material conditions because the social meaning of an utterance or signature can depend on authority, representation, prior status, recording infrastructure, or other relational features. The grammar can also differ across legal orders, cultures, institutions, and historical periods. The formalism therefore does not posit one universal set of contract-formative acts.

A contractual grammar can collapse distinctions and generate possibilities at the same time. The equivalence relation $\sim_{L_C}$ can make distinct relational descriptions symbolically equivalent, while a stabilized status such as “authorized representative” or “registered corporation” can create contract-formative histories that were unavailable before the status existed. The same nomos can therefore reduce representational detail while also enlarging the effective generative horizon.

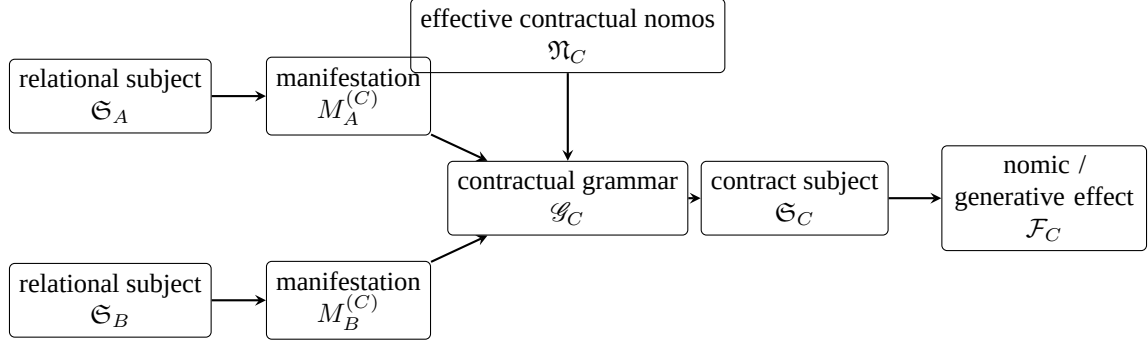


Figure 1: Dependency architecture of the preliminary GR contract model. Manifestation and contractual nomos condition contract formation; the resulting contract can induce effects beyond the direct participant domain.

5.3 Contract-Formative Generative Conditions

The contractual grammar determines which candidate histories are recognized as constituting a contract, while the generative horizon determines which histories the modeled system can actually realize. Contract formation requires these two structures to meet. This subsection introduces the corresponding history family and the partial transformation used to record a realized formation event.

Let $\mathfrak{H}_{\mathfrak{N}}^{\text{pot}}(\Sigma; \mathcal{C}^*)$ be the potential generative horizon defined in Equation 5. For a manifested party profile $\mathbf{M}_C(\omega_\Sigma)$ and contractual nomos $\mathfrak{N}_C$, let $\text{Form}_{C, \mathfrak{N}_C}$ be a $\{0, 1\}$ -valued predicate on candidate extensions at ω_Σ together with the selected manifestation profile. The family of contract-formative histories is stated in Equation 16.

$$\mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma)) = \left\{ \mathcal{K}^+ : \begin{array}{l} \mathcal{K}^+ \text{ satisfies } \mathcal{G}_C(\mathfrak{N}_C, \omega_\Sigma), \\ \text{Form}_{C, \mathfrak{N}_C}(\mathcal{K}^+ \mid \omega_\Sigma, \mathbf{M}_C) = 1 \end{array} \right\}. \quad (16)$$

Equation 16 separates recognition from realizability. Membership in $\mathfrak{C}_{C, \mathfrak{N}_C}$ means that the effective nomos would recognize the candidate extension as forming the relevant contract if that extension were realized. The equation does not imply that the candidate extension belongs to the subject-system’s generative horizon.

Potential contract formation is available when the recognized history family intersects the potential generative horizon. The condition is stated in Equation 17.

$$\mathfrak{H}_{\mathfrak{N}}^{\text{pot}}(\Sigma; \mathcal{C}^*) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma)) \neq \emptyset. \quad (17)$$

For the actual condition profile c_Σ , effective contract formation is available when Equation 18 holds.

$$\mathfrak{H}_{\mathfrak{N}}^{\text{eff}}(\Sigma; c_\Sigma) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma)) \neq \emptyset. \quad (18)$$

The potential condition in Equation 17 and the effective condition in Equation 18 provide the common formal basis for the later capacity-and-constraint analysis. They allow the analysis to distinguish a subject-system whose potential horizon contains contract-formative histories from one whose potential horizon does not intersect the nomos-defined family, and to distinguish both from a system whose potential intersection is nonempty while current conditions block its realization.

A realized contract formation can be represented by a state-dependent partial update. Let $F_C : \Omega \rightarrow \text{PEnd}(\Omega)$ be a contract-formation schema and let U_C be the induced partial update. The update is stated in Equation 19.

$$U_C(\omega) = \Phi_C^{[\omega]}(\omega), \quad \Phi_C^{[\omega]} = F_C(\omega), \quad \omega \in \text{Dom}(U_C). \quad (19)$$

The domain of U_C encodes the actual configuration-dependent requirements for executing the modeled formation procedure. Two systems can use the same broad label “contract formation” while selecting different transformations because their nomoi, manifestations, authority structures, or active relations differ.

Assumption 5.3 (Formation-update consistency). Whenever U_C is executed at a configuration ω_Σ , the realized contract-formative history represented by that execution belongs to the effective generative horizon and to $\mathfrak{C}_{C,\mathfrak{N}_C}$ at the same modeled resolution. Conversely, nonempty intersection in Equation 18 establishes availability of at least one recognized history but need not select a unique update U_C .

Assumption 5.3 links the history-family and partial-operator descriptions without identifying them. The history-family construction states what recognized continuations are available; the operator schema states how a selected formation procedure acts on the current configuration.

Claim 5.4 (Prior nomic dependence of modeled contract formation). Within the present reconstruction, the classification of a realized history as contract formation depends on an effective contractual grammar $\mathcal{G}_C(\mathfrak{N}_C, \omega_\Sigma)$. Contract formation therefore occurs within a prior nomic structure at the level of the model, even when the realized contract subsequently modifies that structure.

Claim 5.4 is a structural statement about the present formalization. It does not establish that every historical contract presupposes a fully articulated legal order. A relatively thin linguistic, customary, interpersonal, or institutional nomos can supply the distinctions required for recognition. The claim is sufficient to motivate the paper's later treatment of contract formation as one process within wider nomos formation rather than as an absolute beginning of normativity.

5.4 Contractual Generation and Relational Persistence

When a recognized contract-formative history is realized, the resulting contract can become a persistent relational structure rather than remaining identical with any one utterance, inscription, signature, or administrative record. The 2-complex representation makes this distinction explicit because the formation process can be represented by an extended subcomplex embedded in the realized history.

Let $\Sigma \prec \Sigma'$ delimit a realized contract-formative history. Under the Historical Persistence Convention, the history increment is $\Delta\mathfrak{G}_{\Sigma \rightarrow \Sigma'}$ from Equation 11. A contract-supporting subcomplex is specified in Equation 20.

$$\mathcal{K}_C \subseteq \Delta\mathfrak{G}_{\Sigma \rightarrow \Sigma'}, \quad \text{Form}_{C,\mathfrak{N}_C}(\mathfrak{G}_{\leq \Sigma'} \mid \omega_\Sigma, \mathbf{M}_C) = 1. \quad (20)$$

Equation 20 does not require every cell generated during formation to belong exclusively to the contract. The subcomplex collects the events and relations treated by the model as supporting the persistent contractual relation. Its precise granularity is application-dependent.

Definition 5.5 (Contract subject). A *contract subject* $\mathfrak{S}_C$ is the relationally persistent structure supported by a recognized contract-formative history and represented by $\mathcal{K}_C$ together with the active, symbolic, and nomic relations through which the contract remains efficacious after formation.

Definition 5.5 distinguishes the contract from its manifestations. A written instrument, database entry, oral formula, judicial characterization, or party-specific understanding can be represented by manifestation maps of $\mathfrak{S}_C$. For example, the textual manifestation has the type stated in Equation 21.

$$C^{(\text{text})} = \mathfrak{M}_{\text{text}}(\mathfrak{S}_C). \quad (21)$$

Equation 21 permits several manifestations of the same relational contract to coexist and diverge. The divergence can become procedurally important when a court, institution, party, or later interpreter acts on a manifestation that preserves different distinctions from another manifestation.

Relational persistence also permits termination without historical erasure. A contract can cease to belong to the active relational boundary $\mathcal{B}_\Sigma$ after discharge, expiry, rescission, or another modeled termination event while the formation history remains in $\mathfrak{G}_{\leq \Sigma}$. This distinction supports later analysis of retrospective recognition, historical obligation, and cross-nomic interpretation without requiring a past contract to remain currently operative.

5.5 Contract-Induced Nomic Fields

A relationally persistent contract becomes socially significant when it affects relations beyond its own record of formation. The term *contract-induced nomic field* denotes the distributed or configuration-dependent structure through which $\mathfrak{S}_C$ modifies recognition, admissibility, obligation, interpretation, or generative possibility across a specified domain. The field terminology follows the representational discipline of Subsection 4.8: distributed structure and transformation remain distinct formal roles.

At the minimal operational level, a contract-induced effect can be detected through a change in the nomos-conditioned admissible operator family. Let ω_Σ be the pre-formation configuration and $\omega_{\Sigma'} = U_C(\omega_\Sigma)$ the post-formation configuration. The opened and closed operator families are defined in Equation 22.

$$\begin{aligned}\mathfrak{O}_C^+ &= \mathfrak{O}_{\mathfrak{N}_{\Sigma'}}^{\text{adm}}(\omega_{\Sigma'}) \setminus \mathfrak{O}_{\mathfrak{N}_\Sigma}^{\text{adm}}(\omega_\Sigma), \\ \mathfrak{O}_C^- &= \mathfrak{O}_{\mathfrak{N}_\Sigma}^{\text{adm}}(\omega_\Sigma) \setminus \mathfrak{O}_{\mathfrak{N}_{\Sigma'}}^{\text{adm}}(\omega_{\Sigma'}).\end{aligned}\tag{22}$$

Equation 22 records operations that become newly admissible or cease to be admissible after the contract-formative history. A contract can, for example, create authorization, claims, duties, enforcement routes, exit procedures, or later transactions, while also closing alternatives that were available before commitment. The notation is descriptive and does not assume that either enlargement or restriction is normatively preferable.

For applications requiring distributed local structure, the contract field can be represented over a selected collection of cells $\mathcal{C}(U_C)$ in the domain affected by the contract. Equation 23 gives a general field-like assignment.

$$\eta_C : \mathcal{C}(U_C) \longrightarrow Y_C,\tag{23}$$

where Y_C is an application-specific space of local nomic or relational parameters. The field can parameterize local state-dependent transformations according to Equation 24.

$$\eta_C \longmapsto \Phi[\eta_C], \quad \Phi[\eta_C] : \Omega \rightharpoonup \Omega.\tag{24}$$

Equations 23 and 24 provide the operator-algebra-inspired bridge advertised in the subtitle. A stronger operator-algebra representation can be introduced when a justified linear state space and operator algebra are supplied. The present derivation requires only the weaker distinction between distributed contract-supported structure and the partial transformations parameterized by that structure.

Definition 5.6 (Contract-induced nomic field). The symbol $\mathcal{F}_C$ denotes the model-relative contract-supported structure through which the persistent contract subject changes at least one represented active relation, admissibility condition, or generative-horizon component over a specified domain. Equations 22–24 provide operational representations of components of $\mathcal{F}_C$; a particular application need not instantiate every component.

Definition 5.6 keeps the field concept distinct from any one operator. The field records distributed or configuration-dependent nomic efficacy, while a partial transformation such as $\Phi[\eta_C]$ records one state-changing realization conditioned by that structure.

Under the conservative temporal representation of Subsection 4.7, the effects of $\mathfrak{S}_C$ can concern accumulated history, the active relational boundary, and possible continuation in different ways. A later recognition event can generate a new legal or institutional relation to an earlier event without deleting that event; a current contract can change active claims and obligations; and the resulting operator family can alter the effective generative horizon. These are temporally differentiated effects of one relationally persistent structure rather than three independent definitions of nomos.

5.6 Participation, Recognition, and Effect Domains

The final distinction in the general reconstruction separates the subjects who participate directly in formation, the subjects or relations made legible to the contractual grammar, and the subjects whose relational

possibilities are affected by the resulting contract. These domains can overlap extensively without being identical. Their separation supplies the common diagnostic structure used by the three later limitation analyses.

Let $\mathcal{S}$ denote the family of relational subjects represented in the relevant model. Definition 5.7 introduces three contract-relative domains.

Definition 5.7 (Participation, recognition, and effect domains). For a realized contract subject $\mathfrak{S}_C$ in a specified model, define:

1. the *participation domain* $\mathcal{P}_C \subseteq \mathcal{S}$ as the subjects whose manifested actions enter the modeled contract-formative history as direct participants;
2. the *recognition domain* $\mathcal{R}_C \subseteq \mathcal{S}$ as the subjects whose manifestations, interests, statuses, claims, or represented relations are made legible to the contractual grammar at the selected resolution;
3. the *effect domain* $\mathcal{D}_C \subseteq \mathcal{S}$ as the subjects for which the contract-induced field changes at least one modeled active relation, admissible transformation, or effective generative possibility.

The effect domain can be detected operationally through the admissible operator family or the effective generative horizon. Equation 25 defines the corresponding operationally detected subset.

$$\mathcal{D}_C^{\text{op}} = \left\{ \mathfrak{S}_i \in \mathcal{S} : \mathfrak{D}_{i,\text{pre}}^{\text{adm}} \neq \mathfrak{D}_{i,\text{post}}^{\text{adm}} \text{ or } \mathfrak{H}_{i,\text{pre}}^{\text{eff}} \neq \mathfrak{H}_{i,\text{post}}^{\text{eff}} \right\}. \quad (25)$$

By Definition 5.7, $\mathcal{D}_C^{\text{op}} \subseteq \mathcal{D}_C$. Equation 25 is model-relative and need not exhaust every channel through which the contract affects a subject. An application can refine effect by distinguishing legal, material, ecological, epistemic, or other relational channels.

Proposition 5.8 (Domain non-identity). *The formal architecture of this section imposes no equality among $\mathcal{P}_C$, $\mathcal{R}_C$, and $\mathcal{D}_C$. In particular, a model can admit subjects in $\mathcal{D}_C \setminus \mathcal{P}_C$, subjects in $\mathcal{R}_C \setminus \mathcal{P}_C$, or direct participants whose relational histories are represented only partially in $\mathcal{R}_C$.*

Proof. Definition 5.7 uses independent membership conditions. Participation is defined by direct contribution to the modeled formation history, recognition by legibility under the contractual grammar, and effect by change in a modeled active relation, admissible operator family, or effective generative horizon. None of these conditions entails either of the other two under the definitions supplied in this section. The stated set differences are therefore admissible whenever an application supplies corresponding subjects. $\square$

Proposition 5.8 is structural rather than normative. A difference among the three domains does not establish injustice, invalidity, or exclusion in a morally objectionable sense. Its analytical role is to prevent a justificatory procedure based on direct participation from being treated automatically as a complete account of every relational subject affected by the resulting nomic field.

Table 5 summarizes the contract architecture developed in this section and identifies the later limitation to which each object contributes most directly.

The reconstruction developed in this section places contract formation inside a wider history of manifestation and nomos formation. Relational subjects become contractually legible through selective manifestations; a historically effective nomos supplies the grammar under which a generative history can count as contract formation; realized formation can generate a persistent relational contract; and the resulting contract can change later active relations and generative possibilities. The next three sections use this common architecture to re-examine distinct limitation families: the relation between generative horizons and nomos-defined contract-formative histories; the cross-nomic manifestation problem raised by nonhuman subjects; and the formation of shared contractual interfaces across heterogeneous nomic systems.

Table 5: Formal objects in the GR reconstruction of contract formation.

Object	Analytical role	Later diagnostic use
$M_i^{(C)}$	Contract-relative manifestation of relational subject $\mathfrak{S}_i$	Separates subjecthood from contractual legibility and supports cross-nomic analysis
$\mathcal{G}_C(\mathfrak{N}_C, \omega)$	Symbolic and institutional grammar of recognized contract formation	Makes the historical and nomic dependence of contract criteria explicit
$\mathfrak{C}_{C, \mathfrak{N}_C}$	Histories recognized by the nomos as contract-formative	Provides the comparison object for capacity and constraint
U_C	State-dependent partial update for realized formation	Records configuration-specific executability and generated relational change
$\mathfrak{S}_C$ and $\mathcal{K}_C$	Persistent contract subject and its supporting history complex	Separates the relational contract from textual or institutional manifestations
$\eta_C, \Phi[\eta_C]$	Distributed contract-supported structure and parameterized transformation	Represents contract-induced nomic effects without requiring a physical field ontology
$\mathcal{P}_C, \mathcal{R}_C, \mathcal{D}_C$	Participation, recognition, and effect domains	Locates different forms of contractual boundary and mediation problem

6 Contract-Formative Capacity and Constraint

The first GR re-explanation concerns contract formation within a contractual grammar that is already sufficiently specified for the subject-system under analysis. The formal categories describe relations inside that model and remain distinct from classifications of persons. The section distinguishes potential generative horizons from effective horizons under present conditions, relates both to the histories recognized by a particular nomos as contract-formative, separates generative constraint from a nomos-relative contract-formative gap, and then examines developmental, supported, and represented participation. Disability and childhood return at the end as heterogeneous cases in which these relations can combine differently.

The analysis retains the scope discipline established in Section 3. Disability and childhood contain heterogeneous forms of agency, dependency, communication, support, and legal status. The formal categories introduced below describe positions within a specified contract model. They do not provide clinical classifications, rank persons, or determine moral standing. The distinction is especially important because the same relational subject can occupy different formal positions under different nomoi, condition profiles, or relational slices.

For readability, when the configuration and manifestation profile are fixed by the surrounding discussion, the arguments of $\mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma))$ are occasionally suppressed and the family is written simply as $\mathfrak{C}_{C, \mathfrak{N}_C}$.

6.1 Potential and Effective Generative Horizons

The generative horizon introduced in Subsection 4.4 is a history-relative possibility domain and carries no scalar measure of ability by definition. For contract analysis, the relevant object is the part of that horizon in which the participation of a selected subject is represented at the resolution required by the contractual grammar. Let i denote a relational subject represented in the configuration at slice Σ . The subject-indexed potential and effective horizons are written as subsets of the system-level horizons in

Equation 26.

$$\begin{aligned}\mathfrak{H}_i^{\text{pot}}(\Sigma; \mathcal{C}^*) &\subseteq \mathfrak{H}_{\mathfrak{A}}^{\text{pot}}(\Sigma; \mathcal{C}^*), \\ \mathfrak{H}_i^{\text{eff}}(\Sigma; c_\Sigma) &\subseteq \mathfrak{H}_{\mathfrak{A}}^{\text{eff}}(\Sigma; c_\Sigma).\end{aligned}\tag{26}$$

Equation 26 does not isolate the subject from its relations. Membership means that the candidate history retains the subject's contract-relevant manifestations, operations, or represented relations at the chosen modeling resolution. The horizon can therefore change when linguistic support, representation, institutional authorization, technical assistance, or another relational condition changes.

The effective horizon remains a restriction of the potential horizon under the current condition profile. Equation 27 states the relation used throughout this section.

$$\mathfrak{H}_i^{\text{eff}}(\Sigma; c_\Sigma) \subseteq \mathfrak{H}_i^{\text{pot}}(\Sigma; \mathcal{C}^*).\tag{27}$$

Equation 27 gives a formal place for a distinction that is often compressed in ordinary discussions of capacity. A subject can possess a potential route to a contract-formative history while the route remains unavailable under the actual configuration. Conversely, absence from the potential horizon relative to the specified condition family expresses a different structural relation and cannot be inferred merely from current nonperformance.

The condition family $\mathcal{C}^*$ is part of the model. A generous family can include accessible communication, additional time, assistive technology, supported decision-making, translation, or other conditions treated as suitably available for the analytical question. A narrower family can omit some of these possibilities. Claims concerning potential capacity are therefore indexed to the condition family under consideration rather than presented as context-free properties of a person.

Remark 6.1 (Generative horizon and personal capacity). The expression *generative capacity* is used in this paper only as informal shorthand for a subject-system's modeled generative horizon relative to specified conditions. The formal object is a family of reachable histories. It is not a scalar quantity located intrinsically inside the subject.

Remark 6.1 preserves the broader meaning of generativity developed in Subsection 4.3. Change, composition, constraint, preservation, collapse, opening, and closure all contribute to the histories a system can generate. Contract-formative capacity concerns one restricted relation between that wider generativity and a particular contractual nomos.

6.2 Nomos-Defined Contract-Formative Conditions

The second object in the comparison is supplied by the contractual nomos rather than by the subject. Section 5 defined the family $\mathfrak{C}_{C, \mathfrak{N}_C}$ of candidate histories that the effective nomos would recognize as forming a contract of type C . The present subsection gives that family a capacity-oriented interpretation and clarifies the limited sense in which a contract-formative threshold can be introduced.

For subject i , potential direct contract formation is available when Equation 28 holds.

$$\mathfrak{H}_i^{\text{pot}}(\Sigma; \mathcal{C}^*) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma)) \neq \emptyset.\tag{28}$$

Effective direct contract formation is available under the current conditions when Equation 29 holds.

$$\mathfrak{H}_i^{\text{eff}}(\Sigma; c_\Sigma) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma)) \neq \emptyset.\tag{29}$$

Equations 28 and 29 make contract-formative adequacy a relation between two history families. This formulation avoids assuming that understanding, communication, assent, memory, practical reasoning, or another relevant feature can be reduced to a common numerical scale.

Some applications nevertheless require a more compact statement of a minimum contract-formative profile. Such a threshold is secondary to the history-family construction. Let Q_C be a model-specific

space of contract-relevant generative profiles and let χ_C map candidate histories to that space. If the contractual nomos supplies a preorder $\preceq_C$ on Q_C , the recognized region is defined in Equation 30.

$$\mathcal{A}_{C, \mathfrak{N}_C} = \{q \in Q_C : q \text{ is recognized by } \mathfrak{N}_C \text{ as sufficient for formation of } C\}. \quad (30)$$

When $\mathcal{A}_{C, \mathfrak{N}_C}$ contains minimal elements under $\preceq_C$, their family is denoted by Equation 31.

$$\Theta_{C, \mathfrak{N}_C}^{\min} = \text{Min}_{\preceq_C} \mathcal{A}_{C, \mathfrak{N}_C}. \quad (31)$$

Equation 31 formalizes a nomos-defined contract-formative threshold without presuming a unique scalar minimum. Several incomparable minimal profiles can exist, and an application may lack a justified preorder altogether. In that case, Equations 28 and 29 remain the primary criterion.

The threshold is historically situated. A different legal order, linguistic system, institutional procedure, or cultural history can generate a different contractual nomos $\mathfrak{N}'_C$ and hence a different recognized history family or threshold family. The same subject-system can therefore occupy different contract-formative positions under $\mathfrak{N}_C$ and $\mathfrak{N}'_C$ without any change in its underlying potential horizon.

Claim 6.2 (Nomos relativity of contract-formative sufficiency). Fix $\mathfrak{H}_i^{\text{pot}}(\Sigma; \mathcal{C}^*)$. The availability of potential direct contract formation can change when the effective contractual nomos changes from $\mathfrak{N}_C$ to $\mathfrak{N}'_C$, because the recognized history family $\mathfrak{C}_{C, \mathfrak{N}_C}$ is nomos-dependent.

Claim 6.2 follows directly from Equation 28. It identifies the analytical location of cultural, legal, and institutional variation in contract-formative criteria. The claim does not imply that every threshold is equally defensible or that contractual validity is arbitrary. Evaluation of a threshold requires legal, empirical, and normative arguments beyond the structural dependence stated here.

6.3 Generative Constraint

Constraint concerns a subject-system for which a contract-formative history belongs to the potential horizon while current conditions remove every such history from the effective horizon. Definition 6.3 states this relation.

Definition 6.3 (Contract-formative generative constraint). Subject i is *contract-formatively constrained* relative to $(C, \mathfrak{N}_C, \Sigma, c_\Sigma, \mathcal{C}^*)$ when Equation 32 holds.

$$\begin{aligned} \mathfrak{H}_i^{\text{pot}}(\Sigma; \mathcal{C}^*) \cap \mathfrak{C}_{C, \mathfrak{N}_C} &\neq \emptyset, \\ \mathfrak{H}_i^{\text{eff}}(\Sigma; c_\Sigma) \cap \mathfrak{C}_{C, \mathfrak{N}_C} &= \emptyset. \end{aligned} \quad (32)$$

Equation 32 locates the obstacle in the relation between potential and effective history families. The source of the restriction can be institutional, communicative, material, linguistic, technological, legal, interpersonal, or another modeled condition. The definition does not require the source to be external to the subject in an ordinary-language sense. Fatigue, temporary illness, stress, inaccessible communication, lack of authorization, coercive circumstances, or absence of necessary support can all enter the condition profile if the application treats them as relevant to realizability.

A useful derived object records condition profiles under which the subject has an effective contract-formative route. The enabling set is defined in Equation 33.

$$\mathcal{E}_{i, C} = \left\{c \in \mathcal{C}^* : \mathfrak{H}_i^{\text{eff}}(\Sigma; c) \cap \mathfrak{C}_{C, \mathfrak{N}_C} \neq \emptyset\right\}. \quad (33)$$

If $\mathcal{E}_{i, C}$ is nonempty while $c_\Sigma \notin \mathcal{E}_{i, C}$, the current inability to form the contract is condition-sensitive within the model. This formulation supports a precise distinction between the existence of a generative route and the accessibility of that route under present circumstances.

Proposition 6.4 (Constraint recovery under an enabling condition). *Suppose subject i satisfies Definition 6.3. If there exists $c' \in \mathcal{E}_{i,C}$ and the transition from c_Σ to c' is itself admissible in the selected model, then the model contains a condition change after which effective direct contract formation becomes available to i .*

Proof. Membership $c' \in \mathcal{E}_{i,C}$ gives a nonempty intersection between $\mathfrak{H}_i^{\text{eff}}(\Sigma; c')$ and $\mathfrak{C}_{C,\mathfrak{N}_C}$ by Equation 33. Admissibility of the condition change supplies the modeled route from the current profile to c' . Equation 29 then holds under the changed condition profile. $\square$

Proposition 6.4 is intentionally conditional. It does not imply that an enabling condition is available in practice, costless, noncoercive, or normatively sufficient. Its function is to distinguish a missing route in the current configuration from absence of the route throughout the potential horizon.

6.4 Nomos-Relative Contract-Formative Gaps

A different structure arises when no history in the specified potential horizon satisfies the current nomos's contract-formative grammar. Definition 6.5 names this relation without treating it as a global deficiency of the subject.

Definition 6.5 (Contract-formative gap). Subject i has a *nomos-relative contract-formative gap* for contract type C when Equation 34 holds.

$$\mathfrak{H}_i^{\text{pot}}(\Sigma; \mathcal{C}^*) \cap \mathfrak{C}_{C,\mathfrak{N}_C}(\omega_\Sigma; \mathbf{M}_C(\omega_\Sigma)) = \emptyset. \quad (34)$$

Definition 6.5 differs from constraint in two respects. First, changing conditions within the already specified family $\mathcal{C}^*$ is insufficient to produce a directly recognized contract-formative history. Second, the gap is indexed by the contractual nomos. A change in the recognized history family can alter the classification even when the subject's potential horizon remains fixed.

When the profile representation of Equations 30 and 31 is available, the same structure can be described through a threshold relation. Let $Q_i^{\text{pot}} = \chi_C[\mathfrak{H}_i^{\text{pot}}]$ denote the image of the potential horizon under the profile map. A threshold gap is present when no profile in Q_i^{pot} lies in the recognized region $\mathcal{A}_{C,\mathfrak{N}_C}$. Equation 35 states the condition.

$$Q_i^{\text{pot}} \cap \mathcal{A}_{C,\mathfrak{N}_C} = \emptyset. \quad (35)$$

Equation 35 should be read as a comparison internal to the contractual grammar. It does not establish that the subject possesses globally “less” generativity, nor that the nomos-defined threshold captures every ethically or relationally relevant form of agency.

The distinction between constraint and gap yields the three structurally possible availability states summarized in Table 6. A fourth combination, effective availability without potential availability, is excluded by Equation 27.

Table 6 also clarifies why constraint and gap can coexist at different descriptive levels. A subject can have a gap relative to one contractual grammar while facing additional constraints relative to another grammar under which a potential route exists. The model should therefore state the nomos, contract type, condition family, and relational slice whenever it classifies a case.

6.5 Developmental Contractual Capacity

Developmental cases require the subject-indexed horizon to vary across relational slices. Childhood provides the clearest example because communicative, cognitive, embodied, institutional, and legally recognized forms of agency can change substantially over the history of one relational subject. Contemporary liberal theory likewise treats childhood as involving development, vulnerability, embeddedness, and changing forms of agency rather than a single timeless property [6].

Table 6: Contract-formative availability relative to potential and effective generative horizons.

Potential intersection	Effective intersection	Structural description	Interpretation within the model
Nonempty	Nonempty	Effective direct availability	At least one currently realizable history is recognized as contract-formative
Nonempty	Empty	Generative constraint	A recognized route exists in the potential horizon while current conditions block every such route
Empty	Empty	Nomos-relative contract-formative gap	No history in the specified potential horizon satisfies the present contractual grammar

Let $\Sigma_1 \prec \Sigma_2$ be two slices in the represented history of subject i . A developmental change in potential contract-formative availability is stated in Equation 36.

$$\begin{aligned} \mathfrak{H}_i^{\text{pot}}(\Sigma_1; \mathcal{C}^*) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_{\Sigma_1}; \mathbf{M}_C(\omega_{\Sigma_1})) &= \emptyset, \\ \mathfrak{H}_i^{\text{pot}}(\Sigma_2; \mathcal{C}^*) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_{\Sigma_2}; \mathbf{M}_C(\omega_{\Sigma_2})) &\neq \emptyset. \end{aligned} \quad (36)$$

Equation 36 records a change in the relation between the subject’s generative horizon and the effective contractual grammar. It does not require a monotone increase in capacity. Illness, aging, injury, altered communication conditions, changed legal status, or other historical developments can also shrink, redirect, or restructure the relevant horizon.

The same distinction applies to effective availability. A subject can possess a potential contract-formative route at Σ_1 while legal or institutional rules make the route unavailable, and later acquire effective access through changes in authorization, support, or status. The resulting history should not be compressed into a binary claim that the subject either “has” or “lacks” contractual capacity independently of time.

Proposition 6.6 (Sufficient condition for slice invariance). *Suppose the subject-indexed generative horizon and the nomos-defined contract-formative history family are identified across two relational slices and remain unchanged under that identification. Then the corresponding potential or effective contract-formative availability status is invariant across those slices. Changes in either family can alter the status, although such changes do not by themselves require a change in the truth value of the intersection condition.*

Proof. Equations 28 and 29 define availability by whether two identified history families have nonempty intersection. If both families are unchanged across the compared slices, the intersection and hence its emptiness or nonemptiness are unchanged. If either family changes, the intersection can change; an additional argument is then required to establish invariance or transition of availability. $\square$

Proposition 6.6 explains why childhood is particularly informative for the formal model. A local manifestation of agency at one slice is insufficient to characterize the full relational subject-spacetime. The proposition also applies beyond childhood whenever contract-relevant generativity or institutional recognition changes historically.

6.6 Mediated and Represented Contract Formation

Support and representation introduce additional relational structures rather than eliminating the distinction between direct and mediated formation. The disability literature contains contractual responses in which trustees or guardians represent the interests of persons with severe cognitive disabilities, while broader disability theory emphasizes supported participation, care, and interdependency [9, 30]. The GR reconstruction can represent these responses by distinguishing changes in conditions from changes in who performs the contract-formative operation.

A support relation can alter the effective condition profile while leaving the subject's own manifested operations inside the formation history. Let s denote a support structure and let $c_\Sigma \oplus s$ denote the supported condition profile. Supported direct availability is present when Equation 37 holds.

$$\mathfrak{H}_i^{\text{eff}}(\Sigma; c_\Sigma \oplus s) \cap \mathfrak{C}_{C, \mathfrak{N}_C} \neq \emptyset. \quad (37)$$

Equation 37 models support as a transformation of conditions. Depending on the application, s can represent accessible communication, interpretation, assistive technology, additional deliberative time, procedural accommodation, or another enabling relation. The equation does not require the supported history to be identical with a history available without support.

Representation has a different type. Let r be a relational subject authorized by the modeled nomos to represent i , and let $\mathfrak{S}_{R(i,r)}$ denote the representation relation generated among the represented subject, representative, and relevant institution or symbolic order. Because the ordinary manifestation map in Equation 1 is unary, introduce a representation-specific manifestation map $\mathfrak{M}_{c_C}^{\text{rep}} : \mathcal{R}^3 \rightarrow X_{c_C}^{\text{rep}}$ for this joint relational structure. The mediated manifestation is stated in Equation 38.

$$M_{i|r}^{(C)} = \mathfrak{M}_{c_C}^{\text{rep}}(\mathfrak{S}_i, \mathfrak{S}_r, \mathfrak{S}_{R(i,r)}). \quad (38)$$

A mediated history family $\mathfrak{H}_{i|r}^{\text{med}}$ can then contain histories in which the representative performs some contract-formative operations under the authority conditions of $\mathfrak{N}_C$. Mediated contract formation is available when Equation 39 holds.

$$\mathfrak{H}_{i|r}^{\text{med}}(\Sigma; c_\Sigma) \cap \mathfrak{C}_{C, \mathfrak{N}_C}(\omega_\Sigma; M_{i|r}^{(C)}) \neq \emptyset. \quad (39)$$

Equation 39 does not identify the representative with the represented subject. The realized history includes an additional relation of representation and can therefore differ in participation, manifestation, evidentiary basis, and later contestability from a direct formation history.

Remark 6.7 (Support and representation). Support primarily modifies the conditions under which a subject's own contract-relevant generativity becomes effective. Representation introduces another relational subject or interface whose operations can be recognized by the nomos on behalf of the represented subject. Practical institutions can combine both structures.

Remark 6.7 permits more precise analysis of contractual responses to dependency. A support intervention can move a case from generative constraint to effective availability without changing the underlying contractual grammar. Representation can create a mediated formation route even where direct potential availability remains absent under the current grammar. Both mechanisms can also change the manifestations through which the subject becomes legible to the institution.

The fidelity or justice of representation remains a separate question. The representation relation can preserve some distinctions and collapse others, and the representative can possess interests, information, or incentives that differ from those of the represented subject. The present section records the additional relational structure without treating mediated formation as normatively equivalent to direct formation.

6.7 Disability and Childhood under the Generative Reconstruction

The formal distinctions developed above provide a re-description of the first limitation family without assigning one structure to every case. Disability can involve contract-formative constraint, a nomos-relative contract-formative gap, mediated formation, combinations of these structures, or none of them

for a particular contract type. Childhood adds a strongly historical dimension because the relation between generative horizon, support conditions, authorization, and contractual grammar can change across the subject’s development. These possibilities align with the literature reviewed in Subsections 3.1 and 3.2, which treats severe cognitive disability, dependency, representation, developing agency, and differentiated legal status as distinct problems rather than one homogeneous absence of rationality [21, 3, 9, 6].

The reconstruction suggests a specific explanation for why contract-based models encounter pressure in these cases. A contractual nomos historically stabilizes a family of histories that count as valid formation. Relational subjects possess heterogeneous and historically changing generative horizons. Actual environments further restrict those horizons. Difficulties arise when direct justification or legal effect is tied closely to recognized contract-formative participation while the relevant subject lies outside the effective intersection for reasons that can originate in conditions, in the nomos-defined grammar, in historical development, or in the mediation structure itself.

This explanation relocates the capable/incapable boundary. Within the present model, “capacity to contract” is a derived relation among a relational subject, a generative horizon, a condition family, a manifestation context, and an effective contractual nomos. It is therefore possible for the same subject to be directly contract-capable in one institutional setting, contract-formatively constrained in another, dependent on mediated formation in a third, and outside the recognized history family of a fourth. The classifications concern contract formation under specified conditions rather than the subject’s total generativity or ethical status.

The participation, recognition, and effect domains from Definition 5.7 add a further qualification. A subject can lie outside the direct participation domain $\mathcal{P}_C$ while remaining inside $\mathcal{R}_C$ or $\mathcal{D}_C$. The formalism therefore does not identify direct contract-formative capacity with the scope of persons affected by, represented within, or potentially protected by a contractual arrangement. This distinction captures one structural source of the difficulty emphasized by Nussbaum: the description of the parties to a justificatory construction and the later scope of justice need not coincide [21].

Existing contractual responses can now be located more precisely. Supported participation modifies the effective condition profile. Trusteeship or guardianship introduces a representation relation and a mediated history. Revised accounts of cooperation can alter the contractual grammar or the recognized history family. Development-sensitive approaches can allow the relation between horizon and grammar to change across slices. The GR framework does not choose among these responses. It identifies which formal component each response changes and which distinctions remain for normative evaluation.

The first limitation family is therefore explained without treating generative constraint or a nomos-relative contract-formative gap as a single personal deficit. The formal problem concerns the fit among historically generated contractual criteria, heterogeneous generative horizons, actual enabling conditions, and available mediation. The next section examines a different structure. In the species-membership case, the central issue can arise before any meaningful threshold comparison is available, because a human contractual grammar and a nonhuman relational world need not share the same nomic discrimination structure.

7 Species Heterogeneity and Cross-Nomic Manifestation

The species case shifts the analysis from within-grammar capacity to the prior problem of cross-nomic manifestation. A nonhuman relational subject can possess persistent organization whose relevant distinctions are not naturally typed by a human contractual nomos. The section therefore examines nonhuman relational and nomic plurality, human symbolic manifestation, translation and distinction loss, nomic-domain mismatch, and the additional ethical nomos required for evaluation. The resulting account explains why failure to enter a human contract procedure can reflect limits in the manifestation interface, without requiring a scalar ranking of human and nonhuman generativity.

The distinction matters because the capacity analysis in Section 6 presupposed that the subject-indexed generative horizon and the contract-formative history family could be meaningfully compared within one contractual grammar. Species heterogeneity can present an earlier problem. A human con-

tractual nomos can lack a justified mapping from a nonhuman relational world into the profile space on which its contract-formative comparison is defined. Under that condition, describing the nonhuman subject as merely below a human threshold already presupposes the cross-nomic translation that requires explanation.

7.1 Nonhuman Relational Worlds and Nomic Plurality

The GR framework treats relational reality independently from membership in a human symbolic order. A nonhuman subject can therefore be represented by a relational spacetime $\mathfrak{S}_A$ with a realized event complex $\mathcal{K}_A$ whether or not the subject participates in human linguistic, legal, or contractual institutions. The same modeling permission extends to persistent collective organization. Research on animal culture documents socially transmitted traditions across diverse nonhuman species, including behavioral patterns that can remain stable across generations, while work on ant colonies documents collective regulation, task allocation, feedback, and environmentally responsive organization [33, 12]. These empirical literatures support a modest structural point: persistent nonhuman relational organization cannot be excluded merely by defining social organization through paradigmatic human symbolic practices.

The present paper uses the term *nonhuman nomic organization* in a deliberately broad GR sense. Let $\mathfrak{N}_A$ denote a relatively persistent relational structure internal to, or emergent from, the modeled history of a nonhuman system that conditions which interactions, distinctions, or continuations remain available within that system. Equation 40 records the typing relation used here.

$$\mathfrak{N}_A \in \mathfrak{R}_{\text{rel}}(\mathcal{K}_A), \quad (40)$$

where $\mathfrak{R}_{\text{rel}}(\mathcal{K}_A)$ denotes the relationally real structures represented as persistent and efficacious relative to the modeled animal history. Equation 40 does not assert that $\mathfrak{N}_A$ contains law, morality, reflective rule-following, or propositional obligation. It identifies only a possible nomic role at the level of relational organization.

Caution 7.1 (Nomic organization and moral normativity). Evidence of collective regulation, social learning, or behavioral tradition does not by itself establish that a nonhuman system possesses moral norms, legal rules, or human-like contractual agency. The notation $\mathfrak{N}_A$ is a GR representation of persistent relational organization. Stronger claims require independent ethological, cognitive, philosophical, and normative arguments.

Caution 7.1 prevents the species analysis from replacing one anthropocentric reduction with an unsupported projection in the opposite direction. The relevant GR claim is narrower: a human contractual grammar is one historically generated nomic structure among potentially heterogeneous relational organizations. Nomic organization is also history-relative. Two populations, colonies, or other relational systems within one species can in principle stabilize different relational distinctions and dynamics. Success of a human contractual grammar inside human institutional history therefore does not establish that its distinctions provide a universal coordinate system for every nonhuman relational subject.

Let $\sim_H$ denote a human contract-relevant equivalence or indiscernibility relation and $\sim_A$ an analogous relation supplied by a selected model of the nonhuman relational system; non-equivalence under either relation records a distinction retained by that model. The inequality in Equation 41 is permitted but not assumed for every pair of models.

$$\sim_H \neq \sim_A. \quad (41)$$

Equation 41 expresses nomic heterogeneity only. It carries no ethical ordering. The later ethical analysis therefore introduces an additional human evaluative structure before any moral conclusion is drawn from the difference.

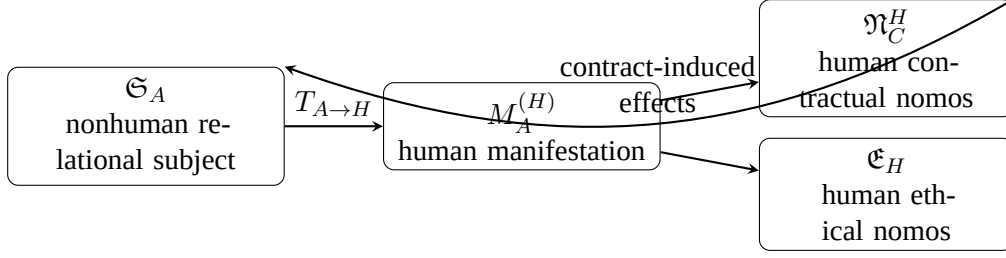


Figure 2: Cross-nomic manifestation of a nonhuman relational subject. Human contractual and ethical nomoi operate through a selective human-readable manifestation; the return arrow denotes effects on the relational subject.

7.2 Human Symbolic Manifestations of Nonhuman Subjects

Human contractual institutions ordinarily act through manifestations that render a nonhuman subject legible within a human symbolic system. A legal, administrative, economic, scientific, or ordinary-language procedure can manifest the same relational subject under labels such as companion animal, livestock, protected species, research subject, property, population, or ecological actor. Each manifestation preserves selected relations and suppresses others. The three-realities architecture of Subsection 4.1 places these manifested objects in manifestation reality without identifying them with the relational subject they represent.

Let X_A denote a model-relative space of nonhuman relational configurations at the resolution relevant to the inquiry, and let Y_H denote a human symbolic manifestation space. A cross-nomic manifestation map is introduced in Definition 7.2.

Definition 7.2 (Cross-nomic manifestation). A *cross-nomic manifestation map* from a nonhuman relational system into a human symbolic context H has the type stated in Equation 42.

$$T_{A \rightarrow H} : X_A \rightarrow Y_H, \quad (42)$$

The output records the human-legible manifestation used by a specified institutional, linguistic, or contractual procedure.

The partiality in Equation 42 is substantive. Some relations represented in X_A can lack any operationally available counterpart in the human symbolic procedure, while others can be rendered only through coarse categories. Conversely, Y_H can contain distinctions introduced by human law or language that do not correspond to divisions represented in the selected animal-relational model. Cross-nomic manifestation is therefore a transformation of representational structure whose output depends on the selected interface.

The relation to symbolic quotienting can be made explicit without assuming that every manifestation is literally a quotient map. For the human manifestation context, define the induced identification relation in Equation 43.

$$x \sim_{T_H} y \iff T_{A \rightarrow H}(x) \sim_H T_{A \rightarrow H}(y), \quad (43)$$

for configurations on which the manifestation map is defined. Equation 43 identifies which distinctions in the source representation become indistinguishable under the human nomic description.

Figure 2 summarizes the resulting architecture. The figure separates the nonhuman relational subject, its human manifestation, and the two human nomic structures that later use that manifestation for contract and ethical evaluation.

The architecture in Figure 2 also applies to human contractors: human institutions act on manifestations that capture only selected parts of relational histories. The species case becomes distinctive when the manifestation grammar, the contract-formative profile space, and the channels through which the represented subject can contest or revise that grammar differ substantially across the two relational systems.

7.3 Cross-Nomic Translation and Distinction Loss

The manifestation map in Definition 7.2 can preserve some distinctions while collapsing others. The metamodel of Section 4 already represents loss through distinctions that a transformation makes indiscernible. The same structural idea can be applied to cross-nomic manifestation without treating the human and nonhuman equivalence structures as identical.

Definition 7.3 records the distinctions preserved by the animal-relational model and collapsed by the human manifestation.

Definition 7.3 (Cross-nomic distinction collapse). For a cross-nomic manifestation map $T_{A \rightarrow H}$, the *cross-nomic distinction collapse* is defined in Equation 44.

$$\Delta_{A \rightarrow H}^{\text{xn}}(T_{A \rightarrow H}) = \{(x, y) \in X_A \times X_A : x \not\sim_A y, T_{A \rightarrow H}(x) \sim_H T_{A \rightarrow H}(y)\}, \quad (44)$$

The relation is restricted to pairs for which the manifestation map is defined.

Equation 44 describes representational loss relative to two specified discrimination structures. A nonempty collapse relation does not establish error or injustice. Finite symbolic systems routinely suppress distinctions that are immaterial to their purpose. The analytical question is which distinctions are lost, why the human nomos treats them as equivalent, and whether another part of the human normative system later requires those distinctions to remain visible.

Translation can also introduce distinctions. Human legal categories can divide configurations that the source model groups together, for example by assigning different statuses according to ownership, jurisdiction, protected-species classification, or institutional use. The present paper does not impose a symmetric metric of representational distance between $\sim_A$ and $\sim_H$. Such a metric would require additional commensurability assumptions. The relation-valued collapse in Equation 44 is sufficient for the diagnostic argument.

The language analogy used in the motivating discussion can now be stated more precisely. Translation into a target language proceeds through distinctions available within the target language's own history. Translation can be highly successful without preserving the source language's entire semantic partition. Cross-nomic animal manifestation has a comparable structure, with the added complication that the source relational organization need not itself be linguistic. The analogy therefore motivates the formal problem without identifying animal relational organization with human language.

Claim 7.4 (Relational efficacy and representational universality). The relational efficacy of a human nomos does not entail that the equivalence structure carried by that nomos is an ontologically universal partition of the nonhuman relational system.

Claim 7.4 follows from the separation of relational and ontological reality in Subsection 4.1. A human legal category can be stable, institutionally powerful, and causally consequential while remaining a historically generated relational structure. Its efficacy therefore cannot by itself establish that the same partition exhausts the distinctions relevant to another relational subject.

7.4 Nomic-Domain Mismatch in Contract Formation

Section 6 represented contract-formative sufficiency by comparing a subject-indexed generative horizon with a nomos-defined contract-formative history family. That comparison presupposes a shared typing relation: the modeled subject histories must be expressible in the profile or history language on which the contract criterion operates. Cross-species analysis makes this presupposition explicit.

Let Q_C^H denote the human-nomos instance of the contract-relevant profile space Q_C introduced in Subsection 6.2, for a contract type C . A cross-nomic contract-typing map is a partial map of the form stated in Equation 45.

$$\tau_{A \rightarrow C}^H : \mathfrak{H}_A^{\text{pot}}(\Sigma; \mathcal{C}^*) \rightarrow Q_C^H. \quad (45)$$

Table 7: Distinguishing contract-formative threshold relations from cross-nomic typing problems.

Structure	Typing status	Contract relation	Interpretation
Generative constraint	Contract comparison is defined	Potential route exists; current conditions block it	The obstacle lies in effective realizability
Nomos-relative threshold gap	Contract comparison is defined	No potential history satisfies the recognized contractual grammar	The gap is relative to a specified human nomos
Nomic-domain mismatch	Contract comparison is absent, materially partial, or unjustified	Above/below-threshold language lacks a warranted common type	The prior problem concerns cross-nomic manifestation and translation

The map can be induced by human manifestation, observation, interpretation, representation, or another interface. A claim that an animal relational subject lies above or below a human contract-formative threshold is well formed only on histories for which Equation 45 has a justified interpretation.

Definition 7.5 (Nomic-domain mismatch). A *nomic-domain mismatch* occurs relative to a nonhuman subject-system and human contractual nomos when the contract-formative comparison requires a map such as $\tau_{A \rightarrow C}^H$, while the required domain assignment is absent, materially partial, or unjustified for the histories under evaluation.

Definition 7.5 separates the species case from an ordinary threshold gap. A threshold gap has the form developed in Definition 6.5: the subject histories are already typed within the contractual grammar and no potential history falls inside the recognized region. Nomic-domain mismatch concerns an earlier relation. The human grammar has not yet established that the nonhuman generative horizon can be represented on the comparison space without losing the distinctions relevant to the inquiry.

The distinction is stated in Table 7. The table treats the comparison as model-relative; a particular nonhuman subject can occupy different rows under different interfaces and contract types.

Table 7 explains why the statement that an animal possesses insufficient human contractual capacity can be misleading. In some applications the comparison can be meaningful and the result can indeed be a threshold gap. In others, the human threshold is applied only after a selective cross-nomic manifestation. The conclusion then concerns the manifested object $T_{A \rightarrow H}(\mathfrak{S}_A)$ under a human grammar and should not be generalized to the total generativity of $\mathfrak{S}_A$.

This point also clarifies why species membership and disability should not be merged into one deficit category. Some disability cases are modeled within a shared human contractual grammar and concern constraint, support, development, or threshold relations. The species case can involve those structures as well, while additionally raising whether the comparison grammar itself provides an adequate interface to the nonhuman relational subject.

7.5 Human Ethical Nomos and Cross-Species Evaluation

Nomic heterogeneity alone does not produce an ethical conclusion. Equation 41 can hold while a human ethical theory permits, requires, or remains indifferent to a particular treatment of nonhuman animals. Ethical evaluation therefore requires a further relational structure. The present subsection introduces a human ethical nomos $\mathfrak{E}_H$ to locate that additional premise.

The term *ethical nomos* denotes a relatively persistent human evaluative structure through which selected distinctions, relations, harms, claims, forms of flourishing, vulnerabilities, or other features become normatively salient. The content of $\mathfrak{E}_H$ is not fixed by the GR formalism. Utilitarian, capabilities-based, rights-based, contractualist, virtue-theoretic, religious, and other ethical systems can instantiate

different evaluative structures. Nussbaum’s capabilities approach and contractarian attempts to extend protection to nonhuman animals illustrate that human ethical and political theories can place nonhuman beings within their evaluative scope even when those beings do not perform the modeled contract in the paradigmatic human form [21, 28, 25].

For a selected animal-relational configuration space X_A , let $\mathcal{P}_{\mathfrak{E}_H}^A \subseteq X_A \times X_A$ denote the family of distinctions that the specified human ethical nomos treats as evaluatively material at the resolution of the model. Definition 7.6 identifies a representation-level tension.

Definition 7.6 (Ethical representation tension). A human cross-nomic manifestation $T_{A \rightarrow H}$ exhibits an *ethical representation tension* relative to $\mathfrak{E}_H$ when Equation 46 holds.

$$\Delta_{A \rightarrow H}^{\text{xn}}(T_{A \rightarrow H}) \cap \mathcal{P}_{\mathfrak{E}_H}^A \neq \emptyset. \quad (46)$$

Equation 46 supplies the missing normative bridge in a disciplined form. The ethical issue does not follow from $\sim_H \neq \sim_A$. It arises when the human symbolic or contractual representation collapses distinctions that a specified human ethical nomos itself treats as materially relevant to evaluation. This can occur, for example, when an institutional manifestation retains distinctions useful for ownership, transfer, or administrative classification while omitting distinctions that the applicable ethical theory treats as relevant to suffering, dependency, social attachment, agency, flourishing, or another stated concern. The formalism does not decide which of these concerns belongs in $\mathcal{P}_{\mathfrak{E}_H}^A$.

Claim 7.7 (Separation of genesis and evaluative scope). Within the present GR reconstruction, the historical emergence of $\mathfrak{E}_H$ within human relational history does not require its evaluative domain to be restricted to human subjects.

Claim 7.7 follows from the distinction between the history that generates a relational structure and the domain over which that structure becomes efficacious. Contracts, currencies, legal categories, and institutions can be human-generated while affecting nonhuman relational systems. An ethical nomos can likewise be human-emergent while assigning evaluative significance to nonhuman relations. The claim neither establishes that it should do so nor determines which nonhuman beings fall within its scope.

Definition 7.6 also preserves the possibility of anthropocentric ethics. A human ethical nomos can assign intrinsic standing only to humans and instrumental significance to nonhuman beings. The GR formalism can represent that position. Its purpose is to expose the additional ethical premises required for evaluation, not to derive a particular moral theory from relational heterogeneity.

7.6 Species Membership under the Generative Reconstruction

The GR reconstruction yields a layered explanation of the species-membership limitation. The first layer concerns relational heterogeneity: nonhuman subjects can possess persistent relational organization whose relevant distinctions need not coincide with those stabilized in a human contractual nomos. The second concerns manifestation: human institutions act on selective human-legible manifestations of those subjects. The third concerns translation: manifestation can collapse distinctions preserved by a richer animal-relational model. The fourth concerns typing: a human contract-formative threshold is meaningful only where a justified cross-nomic map places the relevant nonhuman histories into the contractual grammar’s comparison space. The fifth concerns ethics: species heterogeneity and translation loss acquire ethical significance only through an additional evaluative nomos.

The resulting logical structure is summarized in Equation 47. To keep the final step typed, let $\rho_{C, \mathfrak{N}_C^H} : Q_C^H \rightarrow \{0, 1\}$ be the human contractual-recognition map, with value 1 for a profile recognized by $\mathfrak{N}_C^H$ as sufficient for formation of C . Each relation in the sequence is model-relative and requires its own justification.

$$X_A \xrightarrow{T_{A \rightarrow H}} Y_H \xrightarrow{\tau_{A \rightarrow C}^H} Q_C^H \xrightarrow{\rho_{C, \mathfrak{N}_C^H}} \{0, 1\}, \quad (47)$$

with the relational subject $\mathfrak{S}_A$ and nonhuman nomic organization $\mathfrak{N}_A$ supplying the source-side structure represented in X_A , while human ethical evaluation is supplied separately by $\mathfrak{E}_H$. Equation 47 is

Table 8: Generative Relational reconstruction of the species-membership limitation.

Analytical layer	GR object	Required question
Relational organization	$(\mathfrak{S}_A, \mathfrak{N}_A)$	Which persistent relations and distinctions are represented in the nonhuman system?
Human manifestation	$T_{A \rightarrow H}$	Which source distinctions are preserved, collapsed, or newly introduced?
Contract typing	$\tau_{A \rightarrow C}^H$	Is the human contract comparison well defined for the manifested histories?
Contractual evaluation	$\rho_{C, \mathfrak{N}_C^H}$ on Q_C^H	Which manifested profiles count as contract-formative under the human nomos?
Ethical evaluation	$\mathfrak{E}_H$ and $\mathcal{P}_{\mathfrak{E}_H}^A$	Which lost or preserved distinctions matter under the specified human ethical theory?

a typed formal representation; the arrows carry no temporal interpretation. They denote defined mappings between analytical objects and do not assert that animal relational reality is generated by human manifestation.

This sequence explains why a direct inference from nonparticipation to low generativity is unwarranted. A nonhuman subject can fail to enter a human contract procedure because the human contractual grammar is unavailable to it, because a human manifestation omits relevant relations, because the typing map is partial, because the nomos recognizes no contract-formative history after translation, or through some combination of these structures. The result is therefore indexed to the contractual nomos and its interfaces.

The reconstruction also clarifies the literature reviewed in Section 3. Contractarian proposals that extend protection to animals can be interpreted as revisions to the recognition domain, the ethical nomos, the contractual grammar, or the way nonhuman interests are represented within the human justificatory procedure. Their possibility shows why exclusion does not follow from contractual vocabulary alone. The GR contribution is to distinguish the structural locations at which such extensions operate.

Table 8 collects the analytical sequence. The final column identifies the question that must be answered before the next layer can support a stronger conclusion.

Table 8 locates the species frontier within a wider problem of nomos-relative representation. A human contractual nomos can be relationally real, stable, and causally effective while its application to a nonhuman subject remains mediated through selective manifestation. The limitation therefore concerns more than whether an animal satisfies a human threshold. It concerns the conditions under which a historically human contractual grammar can meaningfully represent and evaluate a heterogeneous relational subject, and the additional ethical premises required before representational mismatch supports a normative judgment.

8 Cross-Border Contract and Inter-Nomic Mediation

The nationality and cross-border case moves to a third structural locus: mediation between already articulated contractual nomoi. Two relational systems can each support sophisticated local contract formation while lacking a pre-given shared grammar for joint formation, recognition, and effect. The section develops this problem through heterogeneous local nomoi, formation of a shared interface, category-theoretic translation and recognition, commutative coherence, and generative asymmetry in interface formation. The analysis remains explanatory; it identifies structures required by a cross-border contractual relation without deriving a complete theory of international or global justice.

The nationality limitation is broader than private international contracting. Nussbaum's discussion concerns justice across political boundaries, while Rawls develops a distinct international architecture through representatives of peoples instead of simply carrying the domestic original position unchanged

into the international domain [21, 22]. Cross-border contract is used here as a tractable formal case because it makes the background problem visible: coordination between large relational systems often requires a mediating nomic structure before agreement can be represented as one jointly intelligible contractual event. Existing instruments in international commercial law illustrate this need in a concrete but limited domain. The United Nations Convention on Contracts for the International Sale of Goods provides a uniform regime for qualifying international sales contracts, while the UNIDROIT Principles provide rules designed for international commercial practice across different legal traditions [32, 16]. These instruments leave domestic legal orders in place while exemplifying the creation of a shared contractual layer across heterogeneous legal environments.

8.1 Heterogeneous Contractual Nomoi

Let A and B denote two large relational systems represented by realized complexes $\mathcal{K}_A$ and $\mathcal{K}_B$. Each system can generate a relatively persistent contractual nomos, written $\mathfrak{N}_A^C$ and $\mathfrak{N}_B^C$. The superscript C indicates the contract-relevant part of the wider nomic structure and does not imply that the two systems share one contract type or one criterion of validity.

The local contract-formative history families are written in Equation 48.

$$\mathfrak{C}_A = \mathfrak{C}_{C_A, \mathfrak{N}_A^C}, \quad \mathfrak{C}_B = \mathfrak{C}_{C_B, \mathfrak{N}_B^C}. \quad (48)$$

For the remainder of this section, $\mathfrak{C}_A$ and $\mathfrak{C}_B$ are shorthand for the corresponding local history families evaluated at the selected local configurations and manifestation profiles; arguments of the subject-indexed horizons are likewise suppressed when fixed by context. Equation 48 permits the two local systems to differ in party manifestation, admissible modes of assent, authority, representation, interpretation, remedies, and the other features through which a contract becomes recognizable. Both systems can nevertheless support internally available contract formation. For selected subjects a in A and b in B , local potential availability can hold simultaneously as stated in Equation 49.

$$\mathfrak{H}_a^{\text{pot}} \cap \mathfrak{C}_A \neq \emptyset, \quad \mathfrak{H}_b^{\text{pot}} \cap \mathfrak{C}_B \neq \emptyset. \quad (49)$$

Equation 49 separates the cross-border problem from a simple capacity deficit. Each party can possess a contract-formative route inside its own nomic environment while a common cross-border route remains unavailable.

The relevant heterogeneity is represented in Equation 50.

$$\mathfrak{N}_A^C \neq \mathfrak{N}_B^C. \quad (50)$$

Equation 50 records nonidentity only. It does not imply incompatibility, injustice, national essentialism, or permanent difference. A national border is also not treated as the primitive source of nomic boundaries. Legal, linguistic, commercial, religious, organizational, and professional nomoi can cross state borders, while heterogeneous nomic structures can coexist within one state. The present section uses cross-border contracting because political borders often make inter-nomic mediation institutionally visible.

Remark 8.1 (Contractual capability and nomic heterogeneity). The simultaneous local availability in Equation 49 does not entail the existence of a shared contract-formative history. Local capability concerns intersections with $\mathfrak{C}_A$ and $\mathfrak{C}_B$ separately. Cross-border formation requires an additional structure that relates the two nomic systems.

Remark 8.1 identifies the central analytical transition of this section. The cross-border limitation appears even where both sides are highly generative and institutionally sophisticated. The missing object is a mediating relational structure through which local manifestations can become jointly legible and jointly actionable.

8.2 Shared Nomic Interface Formation

A cross-border contractual interface is represented by a relationally persistent nomic structure $\mathfrak{N}_I$ whose domain includes selected manifestations from both systems and whose rules support at least one shared contract-formative history. The interface can be thin. It need not reproduce the wider legal, ethical, political, or cultural nomos of either side.

Let X_A^C and X_B^C denote local contract-relevant manifestation spaces and let X_I^C denote the interface manifestation space. Translation or mediation into the interface is represented by the partial maps in Equation 51.

$$T_A : X_A^C \rightharpoonup X_I^C, \quad T_B : X_B^C \rightharpoonup X_I^C. \quad (51)$$

The partiality in Equation 51 permits some locally meaningful objects or relations to lack an available interface manifestation. A shared interface therefore need not translate every part of either nomos. Its analytical task is narrower: to support enough common structure for the selected cross-border relation.

The interface becomes contract-formative when the translated manifestations enter a history family recognized by $\mathfrak{N}_I$. Let $\mathfrak{C}_I$ denote that family. Shared contract formation is available for local manifestations $x_A \in X_A^C$ and $x_B \in X_B^C$ when Equation 52 holds.

$$\mathfrak{H}_{AB,I}^{\text{eff}}(T_A(x_A), T_B(x_B)) \cap \mathfrak{C}_I \neq \emptyset. \quad (52)$$

Here $\mathfrak{H}_{AB,I}^{\text{eff}}(T_A(x_A), T_B(x_B))$ denotes the family of interface histories effectively realizable from the selected translated pair under the interface condition profile fixed by the application. It is therefore a history family of the same type as $\mathfrak{C}_I$, making the intersection in Equation 52 well defined. The equation does not require that the translated manifestations preserve every local distinction. It states only that at least one interface-recognized contract-formative history is effectively available.

International commercial instruments provide useful examples of thin shared nomic layers. The CISG supplies uniform rules for qualifying international sales contracts while leaving some matters, including validity and property effects, outside its scope [32]. The UNIDROIT Principles likewise provide a transnationally oriented rule set designed for international commercial practice without replacing every domestic legal institution [16]. Their relevance here is structural: a shared interface can support a bounded contractual domain while substantial local nomic difference remains intact.

This structure gives a precise GR interpretation to the diplomatic intuition often expressed as preserving difference while constructing common ground. A workable interface can generate a nonempty joint corridor without requiring $\mathfrak{N}_A^C = \mathfrak{N}_B^C$. Commonality can therefore be generated at the level required for a selected relation while wider nomic plurality persists.

8.3 Category-Theoretic Translation and Mediation

Category theory provides a compact language for the translation–formation–recognition structure introduced above. The use has a representational status. Categories, functors, and natural transformations are standard categorical objects [20]; the present section uses them to distinguish local nomic systems from a mediating interface without asserting that social reality is fundamentally categorical.

Let $\mathcal{C}_A$ and $\mathcal{C}_B$ denote categories whose objects are contract-relevant manifestations recognized under $\mathfrak{N}_A^C$ and $\mathfrak{N}_B^C$, and whose morphisms are selected transformations that preserve the distinctions required by the local model. Let $\mathcal{C}_I$ denote the corresponding interface category. The mediation maps of Equation 51 are lifted, where the application justifies functoriality, to the functors in Equation 53.

$$\mathbf{T}_A : \mathcal{C}_A \longrightarrow \mathcal{C}_I, \quad \mathbf{T}_B : \mathcal{C}_B \longrightarrow \mathcal{C}_I. \quad (53)$$

Equation 53 is stronger than the partial-map representation. It should be used only when the selected transformations and compositions are preserved sufficiently for a functor to be defined. Where this condition fails, the partial maps of Equation 51 remain the primary representation.

Let $\mathcal{P}_{AB}$ be a selected subcategory of $\mathcal{C}_A \times \mathcal{C}_B$ containing locally represented candidate cross-border pairs, and let $\mathcal{P}_I \subseteq \mathcal{C}_I \times \mathcal{C}_I$ contain their interface-level counterparts. The product mediation functor is stated in Equation 54.

$$\mathbf{T}_{AB} = \mathbf{T}_A \times \mathbf{T}_B : \mathcal{P}_{AB} \longrightarrow \mathcal{P}_I. \quad (54)$$

Let $\mathcal{D}_I \subseteq \mathcal{P}_I$ be the subcategory on which a selected interface contract-formation procedure is admissible. Let $\mathcal{C}_I^C$ denote a category of interface-recognized contract objects and contract-preserving transformations. Contract generation is represented on $\mathcal{D}_I$ by the functor in Equation 55.

$$\mathbf{\Gamma}_I : \mathcal{D}_I \longrightarrow \mathcal{C}_I^C. \quad (55)$$

The separation between $\mathcal{P}_I$ and $\mathcal{D}_I$ preserves a distinction between successful translation into the interface and admissibility for contract formation. A translated pair can therefore be mutually legible while remaining outside the domain of $\mathbf{\Gamma}_I$. Finally, let $\mathcal{C}_A^C$ and $\mathcal{C}_B^C$ be the local categories of recognized contract objects. Recognition or domestication of an interface contract is represented by the functors in Equation 56.

$$\mathbf{R}_A : \mathcal{C}_I^C \longrightarrow \mathcal{C}_A^C, \quad \mathbf{R}_B : \mathcal{C}_I^C \longrightarrow \mathcal{C}_B^C. \quad (56)$$

Equations 53–56 separate three operations that ordinary descriptions of cross-border contracting can compress: translation into a shared interface, contract formation inside that interface, and recognition of the resulting contract within each local nomic system.

Caution 8.2 (Categorical representation). The categories in this subsection are analytical representations of selected manifestation and transformation structures. Functoriality must be justified by the application. Failure to define a functor can itself be informative, because it can indicate that composition or distinction preservation is lost across the proposed interface. The formalism does not infer a categorical ontology of persons, states, legal systems, or contracts.

Caution 8.2 preserves the ontological suspension established in Subsection 4.1. Category theory is used here because a cross-border contract depends on mappings among heterogeneous structures and on the compatibility of different compositional routes. The direct and interface-mediated routes compared in the next subsection are visualized in Figure 3, which places the two local recognition problems in parallel.

8.4 Commutative Coherence in Contract Formation

The categorical formulation permits a sharper question than whether both sides can sign the same text. The relevant comparison is whether formation through the shared interface is coherent with the contract that each local nomos would recognize from the same cross-border relation.

Coherence can be compared only where the interface-formation route is defined. Let $\mathcal{P}_{AB}^I \subseteq \mathcal{P}_{AB}$ denote a selected comparison subcategory whose translated objects and morphisms lie in $\mathcal{D}_I$. Let $\mathbf{\Lambda}_A : \mathcal{P}_{AB}^I \rightarrow \mathcal{C}_A^C$ and $\mathbf{\Lambda}_B : \mathcal{P}_{AB}^I \rightarrow \mathcal{C}_B^C$ denote direct local interpretation functors whenever those interpretations are defined. The interface-mediated routes on the same domain are defined in Equation 57.

$$\tilde{\mathbf{\Lambda}}_A = \mathbf{R}_A \circ \mathbf{\Gamma}_I \circ \mathbf{T}_{AB}|_{\mathcal{P}_{AB}^I}, \quad \tilde{\mathbf{\Lambda}}_B = \mathbf{R}_B \circ \mathbf{\Gamma}_I \circ \mathbf{T}_{AB}|_{\mathcal{P}_{AB}^I}. \quad (57)$$

Strong local mediation coherence holds when the direct and mediated routes are naturally isomorphic. The condition is stated in Equation 58.

$$\eta_A : \mathbf{\Lambda}_A \Rightarrow \tilde{\mathbf{\Lambda}}_A, \quad \eta_B : \mathbf{\Lambda}_B \Rightarrow \tilde{\mathbf{\Lambda}}_B, \quad (58)$$

where η_A and η_B are natural isomorphisms. Equation 58 expresses commutation up to coherent equivalence, with literal equality treated as a stronger special case. A weaker application can replace the natural isomorphisms by noninvertible natural transformations, yielding a lax form of mediation coherence in which translation or recognition introduces an acknowledged directional remainder.

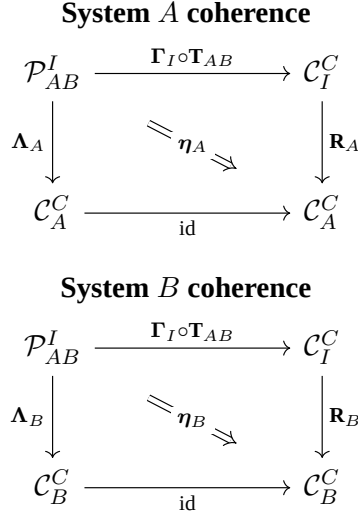


Figure 3: Commutative mediation in cross-border contract formation. Each panel compares direct local interpretation with translation, interface formation, and local recognition; the 2-cell records the resulting coherence relation.

Table 9: Failure modes in cross-border nomic mediation.

Failure mode	Formal location	Structural interpretation
Interface incompleteness	locally relevant objects outside the selected functorial domain	A local relation lacks an available shared manifestation or remains represented only by a partial map.
Translation collapse	nonfaithfulness or many-to-one identification under $\mathbf{T}_A$ or $\mathbf{T}_B$	Distinctions preserved locally become indistinguishable at the interface.
Formation-domain failure	translated pair outside $\mathcal{D}_I$	Mutual legibility does not yet generate an admissible contract history.
Recognition divergence	$\mathbf{R}_A(\mathcal{C}_I)$ and $\mathbf{R}_B(\mathcal{C}_I)$ differ materially	The same interface contract acquires different local manifestations or effects.
Coherence failure	no suitable η_A or η_B	Direct local interpretation and mediated recognition cannot be reconciled at the selected level of equivalence.

Figure 3 visualizes the A -side and B -side comparisons. Each square compares a direct local interpretation with the route through the shared interface.

The diagram in Figure 3 makes several failure modes visible. First, the functorial lift of $\mathbf{T}_A$ or $\mathbf{T}_B$ can fail to cover locally relevant objects, leaving only a partial interface map for those cases. Second, a translation functor can be nonfaithful and identify locally distinct morphisms or relations. Third, Γ_I can be undefined for translated pairs that remain outside the interface contract domain. Fourth, $\mathbf{R}_A$ and $\mathbf{R}_B$ can map the same interface contract into locally different structures. Fifth, the natural transformations required by Equation 58 can fail to exist. These are distinct structural failures and should not be compressed into a general statement that the parties disagree.

Table 9 summarizes these possibilities.

Table 9 gives the category-theoretic diagram a diagnostic role. The purpose of commutativity is not to demand total homogenization. It is to identify whether different routes through translation, formation, and recognition preserve the relations that the analysis treats as contractually material.

8.5 Recognition across Nomic Systems

Successful formation at the interface does not imply identical local recognition. Let $C_I \in \mathcal{C}_I^C$ be an interface-generated contract object. Its local manifestations are defined in Equation 59.

$$C_A^{\text{loc}} = \mathbf{R}_A(C_I), \quad C_B^{\text{loc}} = \mathbf{R}_B(C_I). \quad (59)$$

The two recognized objects in Equation 59 need not be isomorphic at the resolution relevant to the application. One system can attach a different interpretation, remedy set, authority relation, evidentiary status, or field of effects to the same interface contract.

The distinction can be represented at the level of contract-induced fields. Let $\mathcal{F}_C^A$ and $\mathcal{F}_C^B$ denote the fields generated when C_I is recognized within the two local nomic systems. Recognition divergence can then persist even where the interface text or contract object is shared, as stated in Equation 60.

$$\mathcal{F}_C^A \neq \mathcal{F}_C^B. \quad (60)$$

Equation 60 does not require conflict. The two fields can differ while remaining compatible on the domain needed for performance. The analytical point is that shared formation and shared effect are separate achievements.

The CISG illustrates this bounded character of shared recognition. Its uniform rules govern qualifying international sales contracts and contract formation, while matters such as validity and property effects remain outside the Convention's scope [32]. A shared contractual interface can therefore coexist with continued dependence on local nomoi for adjacent questions. This structure is consistent with a GR interpretation in which inter-nomic mediation supports partial coordination while local nomic structures remain distinct.

Definition 8.3 (Cross-nomic recognition profile). For an interface contract C_I , the *cross-nomic recognition profile* is the tuple defined in Equation 61.

$$\text{Rec}_{AB}(C_I) = (\mathbf{R}_A(C_I), \mathbf{R}_B(C_I), \mathcal{F}_C^A, \mathcal{F}_C^B). \quad (61)$$

Definition 8.3 keeps the contract object and its local effects visible in the same comparison. Two interfaces can generate similar written terms while producing different recognition profiles because local nomoi attach different meanings or enforcement structures to those terms.

8.6 Generative Asymmetry and Interface Power

The existence of a shared interface does not imply equal influence over its formation or revision. This section uses *generative asymmetry* for a difference in the modeled ability of relational systems to change the interface history. The term is related to power because the relevant asymmetry concerns differential capacity to alter which contractual directions become available, stable, recognized, or costly. A complete GR theory of power lies outside the present paper.

Let $\mathfrak{H}_{A \triangleright I}^{\text{eff}}$ denote the family of interface histories reachable through admissible interventions initiated or controlled by system A , and define $\mathfrak{H}_{B \triangleright I}^{\text{eff}}$ analogously. Interface-generative asymmetry is present when Equation 62 holds.

$$\mathfrak{H}_{A \triangleright I}^{\text{eff}} \neq \mathfrak{H}_{B \triangleright I}^{\text{eff}}. \quad (62)$$

Equation 62 is deliberately noncardinal. It does not say that one side has “more power” by a scalar amount. It records that the two systems can have different effective repertoires for generating, stabilizing, revising, or exiting the interface.

A stronger directional relation can be defined when one system can reproduce every interface deformation available to the other while possessing additional ones. The dominance condition is stated in Equation 63.

$$\mathfrak{H}_{B \triangleright I}^{\text{eff}} \subsetneq \mathfrak{H}_{A \triangleright I}^{\text{eff}}. \quad (63)$$

Equation 63 provides one possible formal indicator of asymmetric interface power. It should be used only where the histories are typed comparably and the inclusion has an empirical or institutional basis. Other forms of power can arise through agenda setting, control of manifestation categories, enforcement, resources, or the ability to withdraw from the relation even when set inclusion does not hold.

The distinction from contract-formative capacity is important. Both systems can satisfy Equation 49 while Equation 62 also holds. A cross-border contract can therefore involve two capable parties whose influence over the grammar, interpretation, or revision of the shared interface remains unequal. The nationality limitation is partly obscured when the parties are modeled only at the final moment of agreement and the prior generation of the common interface is omitted.

Caution 8.4 (Power and normative evaluation). Generative asymmetry does not by itself establish domination, exploitation, coercion, or injustice. Those conclusions require additional empirical and normative premises. Equations 62 and 63 identify possible structural locations of differential influence over nomos formation.

Caution 8.4 preserves the separation between structural diagnosis and normative evaluation used throughout the paper. The formalism can reveal that the common contractual medium is itself an outcome of generative relations without deciding which distribution of influence is justified.

8.7 Nationality under the Generative Reconstruction

The GR reconstruction treats the nationality limitation as a problem of prior nomos formation and inter-nomic mediation. Two large relational systems can each possess stable contract practices, internally recognized parties, and subjects capable of forming obligations, while a cross-border relation still requires additional translation, interface formation, recognition, and maintenance. The common contractual background therefore cannot be treated as a neutral space that automatically precedes the agreement.

The typed categorical route is summarized in Equation 64; the local and interface nomoi $\mathfrak{N}_A^C$, $\mathfrak{N}_B^C$, and $\mathfrak{N}_I$ provide the nomic structures under which the displayed categories and functors are defined.

$$\mathcal{P}_{AB}^I \xrightarrow{\mathbf{T}_{AB}|_{\mathcal{P}_{AB}^I}} \mathcal{D}_I \xrightarrow{\mathbf{\Gamma}_I} \mathcal{C}_I^C \xrightarrow{(\mathbf{R}_A, \mathbf{R}_B)} \mathcal{C}_A^C \times \mathcal{C}_B^C. \quad (64)$$

Equation 64 is a formal dependency chain and does not impose one universal chronological sequence on the represented objects. The temporal qualifications of Subsection 4.7 continue to apply. Existing interfaces can precede a particular contract, and later contracts can in turn modify the interface nomos.

The reconstruction explains several sources of the cross-border limitation. Distinct nomoi can classify parties or obligations differently. Translation into a shared interface can suppress local distinctions. The contract-formation functor can have a narrower domain than either local contract system. Recognition can diverge after formation. Generative asymmetry can influence which common rules are stabilized. None of these structures requires either side to lack ordinary contractual capacity.

Table 10 collects the resulting analytical layers.

Table 10 identifies the structural contribution of the cross-border analysis to the broader nationality frontier. Contract theory can model agreement after a shared justificatory or legal setting is supplied. The GR reconstruction asks how that shared setting becomes relationally real, which translations it requires, which differences it preserves, and how its formation is distributed across the systems it mediates. The result does not resolve questions of international distributive justice, migration, sovereignty, war, historical responsibility, or global institutional design. It isolates one prior difficulty: a contract cannot by itself explain the emergence of the common nomic conditions required for heterogeneous large relational systems to form and recognize the contract.

Table 10: Generative Relational reconstruction of the cross-border and nationality limitation.

Analytical layer	GR or categorical object	Required question
Local nomic systems	$(\mathcal{K}_A, \mathfrak{N}_A^C)$ and $(\mathcal{K}_B, \mathfrak{N}_B^C)$	Which contractual distinctions and histories are locally recognized?
Shared manifestation	$\mathbf{T}_A, \mathbf{T}_B$ and $\mathcal{C}_I$	Which local distinctions survive translation into a common interface?
Interface formation	$\mathfrak{N}_I$ and $\mathbf{T}_I$	Which translated relations generate an admissible shared contract?
Commutative coherence	η_A, η_B	Do direct local interpretation and interface-mediated recognition remain coherently related?
Local recognition	$\mathbf{R}_A, \mathbf{R}_B$ and $\text{Rec}_{AB}(C_I)$	How does the interface contract become effective in each nomic system?
Interface power	$\mathfrak{H}_{A \triangleright I}^{\text{eff}}$ and $\mathfrak{H}_{B \triangleright I}^{\text{eff}}$	Who can generate, stabilize, revise, or exit the shared interface, and under what conditions?

9 Comparative Structure of Contractual Limitations

The three formal diagnoses can now be compared within the common contract architecture. The comparison identifies the dependency level at which each limitation enters, shows how the mechanisms can coexist without becoming equivalent, and clarifies their shared reliance on prior nomos formation. Disability and childhood, species membership, and cross-border or nationality cases can therefore pressure contract-based justification for different structural reasons even when they are discussed together as boundaries of contractual inclusion. The comparison remains diagnostic and theory-relative; normative conclusions require additional evaluative premises.

9.1 Contract-Formative Capacity Structure

The capacity-and-constraint analysis concerns a relation internal to an already specified contractual grammar. A subject-indexed generative horizon and a nomos-defined contract-formative history family are assumed to be sufficiently well typed for intersection to be meaningful. The primary question is then whether recognized contract-formative histories lie inside the subject-system's potential or effective horizon.

The three availability states in Table 6 can be summarized through the ordered diagnostic tuple in Equation 65.

$$\mathfrak{D}_{\text{cap}} = \left(\mathfrak{H}_i^{\text{pot}}, \mathfrak{H}_i^{\text{eff}}, \mathfrak{C}_{C, \mathfrak{N}_C} \right). \quad (65)$$

Equation 65 is a diagnostic signature and carries no scalar capacity measure by definition. Constraint is located in the difference between potential and effective horizons, while a nomos-relative contract-formative gap is located in the relation between the potential horizon and the recognized history family. Developmental change, support, and representation can alter different components of the tuple without implying that the relational subject itself has acquired or lost a single context-free quantity called contractual capacity.

This structure explains why some disability and childhood cases can remain within one broad human contractual nomos while still challenging a contract procedure. The difficulty can concern present realizability, the historical development of the subject's generative horizon, the contractual grammar's recognized history family, or a mediated route supplied through support or representation. The diagnostic remains meaningful only after the comparison has been typed within the relevant nomos.

Generative asymmetry should be kept separate from this analysis. Two subjects can have different effective horizons while both satisfy the same contract-formative condition. Conversely, two subjects can

have similar horizons while both fail to intersect a particular nomos-defined contract family. Differential generative reach can become relevant to power, bargaining, or dependence, but it does not define the capacity limitation by itself.

9.2 Cross-Nomic Manifestation Structure

The species analysis moves one layer earlier in the dependency structure. A contract-formative threshold or history-family comparison presupposes that the subject's relational histories can be manifested in the profile space on which the human contractual grammar operates. Definition 7.5 isolates the case in which that typing relation is absent, materially partial, or insufficiently justified.

The corresponding diagnostic signature is stated in Equation 66.

$$\mathfrak{D}_{\text{xn}} = \left(T_{A \rightarrow H}, \sim_A, \sim_H, \tau_{A \rightarrow C}^H, \mathfrak{E}_H \right). \quad (66)$$

The first four components of Equation 66 describe manifestation, distinction preservation, and contract-relative typing. The ethical nomos $\mathfrak{E}_H$ enters only when the analysis moves from representational difference to ethical evaluation. This separation is necessary because the inequality $\sim_H \neq \sim_A$ identifies nomic heterogeneity but supplies no ethical verdict by itself.

A cross-nomic manifestation problem can therefore arise even when a human contract procedure is internally coherent and the relevant human participants possess ample contract-formative generativity. The limitation concerns whether the human nomos supplies an adequate interface to the heterogeneous relational subject on which the resulting human nomic field can act. Conversely, a well-supported cross-nomic manifestation does not establish direct contract-formative availability. After translation and typing have been justified, the resulting manifestation can still encounter the capacity, constraint, representation, or participation conditions developed in Section 6.

The ordering of these questions matters analytically. Applying above-threshold or below-threshold language before establishing a warranted typing map can transform a cross-nomic manifestation problem into an apparent capacity deficit. The GR reconstruction therefore treats nomic-domain mismatch as a prior representational issue whenever the comparison relation itself requires explanation.

9.3 Inter-Nomic Mediation Structure

The cross-border analysis concerns a third locus. Each side can possess an internally coherent contractual nomos and locally contract-capable subjects, while the relation between the nomoi remains insufficient for shared contract formation. The limitation is located in the construction and maintenance of a common interface; the direct generative horizon of either party can remain locally sufficient.

The interface diagnostic is collected in Equation 67.

$$\mathfrak{D}_{\text{med}} = \left(\mathbf{T}_A, \mathbf{T}_B, \mathfrak{N}_I, \Gamma_I, \mathbf{R}_A, \mathbf{R}_B \right). \quad (67)$$

Equation 67 records translation into an interface, the shared nomic structure supporting contract formation, the interface formation rule, and recognition back into the local nomoi. Commutative coherence from Subsection 8.4 adds a compatibility criterion among these routes. Generative asymmetry from Subsection 8.6 adds a further question concerning differential influence over formation, stabilization, revision, and exit.

This limitation can therefore persist in the absence of a capacity gap on either side. Equation 49 permits both local systems to contain effectively available contract-formative histories, while Equation 52 can still fail because no shared interface history is available for the selected relation. The same interface can also support formation while later recognition diverges, as represented by Definition 8.3.

The comparison with the species case is instructive. Both analyses involve heterogeneous nomoi and translation. The species analysis asks whether a human contractual grammar provides a warranted manifestation and typing of a heterogeneous relational subject. The cross-border analysis begins from two

local contractual systems and asks whether their selected structures can be mediated through a shared interface that supports formation and recognition. The first problem can arise before a common contractual grammar is well typed for the target subject; the second concerns the generation of common contractual structure between already articulated nomic systems.

9.4 Shared Dependence on Prior Nomos Formation

The three limitation families remain distinct, yet each depends on structures that precede the particular contract at the level of the model. Contract-formative capacity is evaluated against a history family generated by an effective contractual nomos. Cross-nomic manifestation depends on symbolic distinctions and typing relations generated within a human nomic history. Inter-nomic mediation depends on translation rules, interface categories, recognition practices, and a shared nomos that cannot be supplied by the focal contract alone.

This common dependence can be stated as a refinement of Claim 5.4.

Claim 9.1 (Prior-nomos dependence of limitation diagnosis). Within the present reconstruction, classifying a contract limitation as a capacity relation, cross-nomic manifestation problem, or inter-nomic mediation problem requires nomos-conditioned objects whose definitions are logically prior to the focal contract-formative event in the model.

Claim 9.1 concerns formal dependence and leaves universal chronology unspecified. A contractual nomos can itself be the historical product of earlier contracts, institutions, conventions, linguistic practices, conflicts, and revisions. A later contract can also modify the nomos under which subsequent contracts are formed. Prior-nomos dependence therefore permits recursive and historically evolving contract systems.

The common structure does not collapse the three limitation families into one general failure of inclusion. Proposition 9.2 records their structural non-reducibility.

Proposition 9.2 (Structural non-reducibility of the three limitation families). *Within the formal architecture developed in Sections 6–8, the presence of a contract-formative capacity limitation, a cross-nomic manifestation limitation, or an inter-nomic mediation limitation does not entail the presence of either of the other two without additional assumptions.*

Proof. A capacity limitation can be represented inside one contractual nomos with a fully specified manifestation map and no cross-nomic interface by choosing a subject whose potential or effective horizon fails the relevant intersection condition. A cross-nomic manifestation limitation can be represented while the human participants satisfy the contract-formative condition, because the difficulty lies in the partial or unjustified map $\tau_{A \rightarrow C}^H$ for the heterogeneous subject. An inter-nomic mediation limitation can be represented while both local systems satisfy Equation 49, because shared availability additionally depends on the interface maps, interface nomos, formation rule, and recognition structure. These constructions satisfy one limitation condition without requiring the others. Additional empirical or theoretical assumptions can connect the mechanisms in particular applications, but the implications do not follow from the present definitions alone. $\square$

Proposition 9.2 is important for interpretation. Disability, childhood, species membership, and nationality can interact in concrete histories, and a single institution can exhibit more than one limitation at once. The formal comparison nevertheless preserves different explanatory loci so that one case is not redescribed automatically in the vocabulary of another.

Table 11 summarizes the comparison. The table identifies the primary relation at issue, the prior nomic structure presupposed by the diagnosis, and the inference that remains unavailable without further premises.

Table 11: Comparative structure of the three contractual limitation families.

Limitation family	Primary formal relation	Prior nomic structure	Conclusion not supplied by structure alone
Contract-formative capacity and constraint	$\mathfrak{H}_i^{\text{pot}}, \mathfrak{H}_i^{\text{eff}}, \text{ and } \mathfrak{C}_{C, \mathfrak{N}_C}$	Contract grammar and recognized contract-formative histories	Global deficiency of the subject, injustice of the threshold, or normative equivalence of direct and mediated formation
Cross-nomic manifestation	$T_{A \rightarrow H}, \tau_{A \rightarrow C}^H, \sim_A, \text{ and } \sim_H$	Human symbolic and contractual nomos used to manifest and type the heterogeneous subject	Ethical wrongness of nomic difference or a universal hierarchy between human and nonhuman organization
Inter-nomic mediation	$\mathbf{T}_A, \mathbf{T}_B, \mathfrak{N}_I, \Gamma_I, \mathbf{R}_A, \text{ and } \mathbf{R}_B$	Local contractual nomoi and the generated interface nomos	Injustice of noncommutation, legitimacy of one interface grammar, or a preferred distribution of interface power

9.5 Scope of Contractual Justification

The comparative analysis clarifies the scope problem already implicit in Proposition 5.8. A contract-based justificatory argument can take direct participation, hypothetical representation, mutual advantage, reasonable rejectability, or another contract-relative relation as part of its premises. The resulting conclusion can be extended beyond the direct participant set only through whatever representational, ethical, institutional, or inter-nomic bridge the theory supplies. The GR formalism does not select one such bridge, but it makes the extension requirement explicit.

Let $\mathcal{E}_J \subseteq \mathcal{S}$ denote the domain of relational subjects to which a contract-based justificatory conclusion J_C is intended to apply, and let $\mathcal{E}_J^{\text{prem}} \subseteq \mathcal{S}$ denote the subject-domain on which the premises of the selected justificatory construction are defined. A justificatory extension is required whenever Equation 68 holds.

$$\mathcal{E}_J \setminus \mathcal{E}_J^{\text{prem}} \neq \emptyset. \quad (68)$$

Equation 68 is intentionally weak. It does not say that extension is impossible or that a contract theory lacks resources for it. Trusteeship, representation, hypothetical inclusion, moral status principles, international institutions, or other theoretical devices can enlarge $\mathcal{E}_J^{\text{prem}}$ or supply a bridge to the intended evaluative domain. The equation states only that extension requires an additional analytical step that should be made explicit.

The three limitation families expose different forms of this extension problem. Capacity and constraint raise the relation between direct or mediated formation and subjects whose contract-relevant generativity differs from the paradigmatic party model. Species heterogeneity raises the relation between human contractual manifestations and nonhuman relational subjects that can fall within the effect or ethical domain of human nomoi. Cross-border mediation raises the relation between local justificatory structures and a shared interface whose formation and recognition extend across heterogeneous nomic systems.

This comparison supports the paper’s central reinterpretive proposal. Social contract can be modeled as one historically situated process of relational and nomic generation whose intelligibility depends on

prior manifestation, symbolic distinction, admissibility, and mediation structures. The recurring limitations reviewed in Section 3 arise at different interfaces within that wider architecture. Their commonality lies in the dependence of contract on a nomic background that the focal act of agreement does not itself completely generate. Their differences lie in the specific relation that becomes constrained, ill-typed, lossy, or insufficiently mediated.

The comparative result remains narrower than a theory of justice. It identifies the formal location at which further normative premises are needed and preserves the possibility that different contractarian, contractualist, capability-based, relational, or other theories can supply different evaluations of the same structural configuration. The following section states the formal, interpretive, and normative limits of the proposal before the conclusion.

10 Scope and Limitations

The reconstruction supports claims only within the representational, temporal, normative, and empirical assumptions stated in the preceding sections. This section fixes those boundaries by separating formal representation from ontological commitment, structural diagnosis from normative evaluation, and conceptual reconstruction from empirical institutional explanation. It then clarifies the scope of the nomos concept, the status of the three limitation diagnoses, and the evidence required for application. These qualifications delimit the formal claims while preserving the analytical distinctions developed in Sections 4–9.

10.1 Formal Status of the Reconstruction

The formalism developed in this paper is a structural representation of contract formation and its dependence on manifestation, nomos, generative horizons, and mediation. Its principal objects—relational subject representations, contract-relative manifestations, nomos-defined contract-formative history families, partial updates, contract-supported fields, and inter-nomic translation functors—are introduced because they make different dependencies visible. Their mathematical specification does not establish that one unique mathematical structure underlies social contract in every institutional or historical setting.

The 2-complex representation illustrates this status. A labelled complex can retain events, pairwise relations, higher-order relational cells, boundary structure, and partial-order information within one history-bearing object. This makes it useful for the GR subject representation of Definition 4.2. The representation remains resolution-dependent. Another formalism can preserve the same analytically relevant relations through a different data structure, and two applications can require different cell interpretations or labels. The paper therefore treats the 2-complex as a formal realization of relational spacetime structure, without using it to infer a unique cellular ontology for social subjects.

The operator-algebra-inspired language has an equally restricted role. Composition, partial definedness, state dependence, and field-parameterized transformations are sufficient for most derivations used in the paper. A linear operator algebra, Hilbert-space representation, adjoint structure, or physical observable interpretation would require additional assumptions not supplied here. Equations 23 and 24 consequently provide a bridge to richer operator formulations without claiming that contractual or nomic processes instantiate quantum-mechanical operator algebra.

Category-theoretic notation in Section 8 should be read in the same way. Categories and functors provide a disciplined representation of translation, interface formation, and recognition across heterogeneous nomic systems. Commutative or naturally coherent diagrams identify compatibility conditions among those mappings. They do not imply that legal systems, cultures, or political communities are exhausted by categorical objects or that categorical equivalence establishes substantive political or ethical equivalence.

Caution 10.1 (Representational scope). The use of geometric, field-theoretic, operator-algebraic, and category-theoretic language in this paper supports structural comparison at the selected level of resolution.

It does not determine the ultimate ontology of persons, animals, institutions, legal orders, cultures, or political communities.

Caution 10.1 is continuous with the three-reality distinction in Definition 4.1. Relational reality concerns historically persistent and generatively efficacious structures represented within the model; manifestation reality concerns context-dependent access to such structures; ontological reality remains suspended. The paper’s formal conclusions therefore concern relations among modeled objects at the relational and manifestation levels.

10.2 Temporal Representation and Historical Persistence

The temporal treatment used in the paper is similarly layered. The formal programme permits a temporally suspended event structure at T_0 , a generative or precedence relation at T_1 , a conservative history–boundary–continuation slicing at T_2 , and context-dependent epistemic temporal representation at T_3 . The contract analysis relies primarily on the T_2 representation because it permits distinctions among accumulated history, active relations, and possible continuations to be stated directly.

The Historical Persistence Convention adopted at this level treats realized events as retained in later represented history. A later recognition, reclassification, settlement, or contract can add relations to an earlier event and can alter its present legal, symbolic, or institutional manifestation. The convention does not model later events as deleting the earlier realized event from the represented historical complex. This choice supports the analyses of retrospective recognition, contract-induced fields, and developmental capacity without settling the metaphysics of time.

The broader GR architecture leaves open stronger temporal alternatives. A later formalism could work with globally constrained event complexes, weaken the distinction between realized history and possible continuation, or represent apparent backward influence without treating forward sequential update as fundamental. Such extensions would require a revised semantics for generative horizons, historical persistence, and field action. The present results should therefore be read relative to the conservative temporal instantiation actually used in the derivations.

This qualification is especially relevant to statements that a nomos affects the “past,” “present,” or “future.” Within this paper, those expressions denote different relations to a selected slice. The past is represented through retained realized history whose current manifestation can change; the present through an active relational boundary; and the future through possible or effective continuation. The terminology is analytically convenient and does not elevate the selected slicing into an ontological thesis.

10.3 Scope of Nomos and Symbolic Distinction

The term *nomos* is used broadly enough to include historically stabilized structures that condition distinction, admissibility, recognition, and generative possibility. This breadth permits contractual grammar, legal order, symbolic classification, ethical evaluation, and inter-nomic interface formation to be represented within one relational vocabulary. The breadth also creates a risk of treating heterogeneous normative and symbolic phenomena as though they shared one substantive content.

The paper avoids that inference by indexing nomic structures to their role and domain. A contractual nomos $\mathfrak{N}_C$ supplies conditions under which histories count as contract-formative. A human symbolic nomos can condition the manifestation and typing of nonhuman relational subjects. An ethical nomos $\mathfrak{E}_H$ supplies evaluative distinctions required to move from representational difference to an ethical claim. An interface nomos $\mathfrak{N}_I$ supports shared formation and recognition across heterogeneous local nomoi. These structures can interact historically while remaining analytically distinct.

The quotient-like language used for symbolic distinction is likewise limited. An equivalence relation such as $\sim_H$ records which distinctions a selected representation preserves or collapses at the modeled level. A practical symbolic system can also generate distinctions, categories, expectations, and action possibilities that were unavailable before its stabilization. Symbolization in the present framework there-

fore includes both selective collapse and generative restructuring. Treating it as a literal quotient in every application would suppress that second role.

Cross-nomic comparison requires further restraint. The inequality $\sim_A \neq \sim_H$ establishes only that two represented nomic structures discriminate differently. It does not establish that one structure is ethically superior, more rational, more developed, or closer to ontological reality. The ethical-representation condition of Definition 7.6 requires an additional evaluative structure precisely to prevent such conclusions from being derived from heterogeneity alone.

The same restraint applies to the possibility of nonhuman nomic organization. Section 7 permits a nonhuman relational system to possess stable relational organization relevant to cross-nomic analysis. The paper does not claim that such organization is identical to human law, morality, language, or reflective normativity. Application to particular animal species or collectives would require domain-specific evidence concerning interaction, signaling, learning, coordination, persistence, and the relational distinctions preserved by the selected model.

10.4 Normative Scope of the Limitation Diagnoses

The three limitation families are structural diagnoses. Their formal conditions identify where contract-based reasoning depends on additional assumptions; they do not supply those assumptions automatically. This distinction is central to the interpretation of Sections 6–9.

A contract-formative gap identifies an empty intersection between a subject-system’s potential generative horizon and a nomos-recognized contract-formative history family. The condition does not establish a global deficiency of the subject, the injustice of the contractual nomos, or a duty to remove the threshold. A constraint identifies a difference between potential and effective availability under actual conditions. The condition can motivate questions about support, access, coercion, communication, or institutional design, while the normative assessment of those conditions requires further premises.

A cross-nomic manifestation limitation identifies a problem of typing, translation, or distinction preservation when a human contractual nomos is applied to a heterogeneous relational subject. The condition does not entail an ethical verdict. The ethical step requires a human or otherwise specified evaluative nomos whose domain includes the affected relation. This is why Section 7 separates cross-nomic heterogeneity from the ethical-representation tension.

An inter-nomic mediation limitation identifies fragility or failure in the construction, translation, recognition, or coherence of a shared interface. Noncommutation, translation loss, or asymmetric influence over interface formation can be normatively relevant under a specified political or legal theory, but none is intrinsically unjust by definition. Some differences can reflect legitimate jurisdiction, reliance, competence, finality, or plural institutional purposes. The formalism records the locus of divergence and the additional premise required for evaluation.

Table 12 collects the principal analytical levels and the claims they support. The table also records the corresponding conclusion that remains outside the warrant of the formal object alone.

The table makes the paper’s principal methodological boundary explicit. Structural explanation can clarify why a difficulty arises and where an additional normative bridge is required. It does not replace the ethical, political, or legal argument that supplies the bridge.

10.5 Empirical and Institutional Scope

The present paper is conceptual and formal. It does not estimate the frequency of the three limitation mechanisms, identify their causal effect sizes, or establish that one formal diagnosis applies to every case grouped under disability, childhood, species membership, or nationality. Empirical application requires an explicit translation from the abstract objects of the formalism to observable or reconstructible relational histories.

For contract-formative capacity and constraint, an application would need to specify the contractual grammar, the histories treated as sufficient for formation, the subject-relative possibilities represented in

Table 12: Epistemic status and scope of the principal formal layers.

Analytical layer	Supported use in the present paper	Conclusion requiring additional premises
Relational and manifestation reality	Distinguishes persistent relational structure from context-dependent representation while suspending ultimate ontology	Metaphysical identity of the represented object with the chosen formal structure
2-complex and operator representation	Records histories, boundaries, local relations, partial transformations, and field-like effects	Physical interpretation of social dynamics or uniqueness of the mathematical representation
Contract-formative capacity analysis	Locates potential, effective, and nomos-recognized histories and distinguishes constraint from a nomos-relative gap	Global human capacity ranking, justice of the threshold, or preferred support arrangement
Cross-nomic manifestation analysis	Locates translation, typing, and distinction loss across heterogeneous relational systems	Ethical wrongness of heterogeneity or universal validity of a human symbolic partition
Inter-nomic mediation analysis	Locates interface formation, coherence, recognition, and generative asymmetry across nomic systems	Legitimacy of a particular interface, preferred distribution of power, or substantive international justice

the potential horizon, and the conditions that restrict the effective horizon. Legal capacity rules, communication supports, institutional procedures, developmental evidence, and actual opportunities for participation can inform such a reconstruction. The distinction between potential and effective horizon should not be inferred merely from an observed failure to contract.

For cross-nomic manifestation, an application would need evidence for the relational structures attributed to the nonhuman system and a defensible account of the mapping through which a human symbolic or contractual nomos manifests them. Claims about distinction loss require identifying a distinction represented on the source side and demonstrating that the selected target representation fails to preserve it. The paper's formalism does not license the attribution of a rich nonhuman nomos merely because such an attribution would make the model symmetrical.

For inter-nomic mediation, an application would need to identify the local nomic structures relevant to the transaction or political relation, the translation mechanisms connecting them, the interface rules under which formation occurs, and the recognition paths through which the resulting contract becomes effective locally. National borders can be empirically relevant while remaining an imperfect proxy for nomic boundaries. Multiple legal, cultural, linguistic, commercial, and institutional nomoi can coexist within one state, and transnational institutions can stabilize nomic structures across states.

The same point applies to power. Section 8 treats generative asymmetry as a possible source of differential influence over interface formation, stabilization, revision, and exit. A substantive claim about power requires evidence concerning who can alter the shared grammar, whose manifestations are preserved by the interface, which alternatives remain practically available, and how costs or dependencies are distributed. Difference in generative horizons alone does not establish domination.

Empirical uncertainty can also enter at several levels simultaneously. Histories can be incomplete, manifestations disputed, nomic rules underdetermined, future possibilities uncertain, and recognition practices inconsistent. Later applications may therefore require set-valued, probabilistic, interval-valued,

or competing-reconstruction extensions. Such extensions should preserve the distinction between uncertainty in the evidence and heterogeneity in the modeled relational structure.

10.6 Boundary of the Present Paper

The present analysis stops at explanation. It reconstructs social contract within a broader process of relational nomos formation and uses that reconstruction to explain why contract-formative capacity, species heterogeneity, and cross-border mediation can generate different limitations for contract-based justification. It does not provide a general prescription for constructing ethical relations across heterogeneous subjects.

Several questions therefore remain outside the present paper. One concerns the design of shared nomoi when direct contractual participation is unavailable or when the relevant relational systems possess substantially different manifestation structures. A second concerns the ethical status of artificial agents whose generative horizons, symbolic systems, persistence conditions, and forms of representation can differ from those of human subjects. A third concerns relations among multiple artificial agents, between humans and nonhuman animals, and with possible future heterogeneous subjects for which present human contractual grammars may provide only partial interfaces. These questions require a positive account of inter-nomic ethical formation beyond the diagnostic reconstruction developed here.

The present formalism also leaves open the deeper theory of power. Generative asymmetry has been separated from contract-formative insufficiency because the two answer different questions. A fuller GR theory would need to specify how asymmetries in the ability to alter fields, nomoi, interfaces, manifestations, and future generative horizons become stabilized and how such stabilization should be evaluated. The current paper uses power only where it affects the interpretation of contractual interfaces.

Finally, the analysis does not establish that social contract should be abandoned. Contractarian and contractualist traditions contain resources for representation, hypothetical inclusion, public justification, reciprocity, reasonable rejectability, and institutional mediation. The GR reconstruction supplies a way to locate the prior relational structures on which such resources operate and to distinguish several sources of limitation that can otherwise be compressed into a single language of exclusion. The conclusion returns to that narrower contribution and summarizes the resulting reinterpretation.

11 Conclusion

This paper has reinterpreted social contract within a Generative Relational account of nomos formation. The reconstruction begins from a simple dependency: contractual justification requires more than a pair of pre-given parties and an agreement rule. Parties must become legible through manifestations, symbolic distinctions must stabilize what counts as assent, refusal, representation, and obligation, and an effective nomos must recognize some histories as contract-formative. These conditions can precede a focal contract in the model while remaining historically generated and revisable. Contract formation is therefore situated within a wider process of nomos formation and no longer serves as the model's self-sufficient normative origin.

The GR foundations make that dependency explicit while preserving ontological restraint. Relational subjects are represented as extended histories or spacetimes; manifestation records context-dependent access to those subjects; generative horizons represent reachable histories under specified conditions; and nomoi record relatively stable structures of distinction, admissibility, recognition, and generative possibility. A labelled 2-complex provides one convenient representation of history-bearing relational structure, while operator-algebra-inspired and field language describe transformation and distributed efficacy where those roles are analytically useful. These devices remain representations at the relational and manifestation levels, with ultimate ontology left open.

The first limitation family concerns contract-formative capacity and constraint within an already typed contractual grammar. Potential and effective generative horizons distinguish histories available

under suitably admissible conditions from those available in the actual configuration. A generative constraint removes contract-formative histories from the effective horizon while they remain potentially available; a nomos-relative contract-formative gap arises when the potential horizon contains no history recognized by the prevailing contractual nomos as sufficient for direct formation. Support, representation, development, and changes of nomos can modify different parts of this relation. Contractual capacity is consequently represented as a contextual relation among subject, horizon, conditions, manifestation, and nomos, with no intrinsic scalar capacity assumed.

The second limitation family concerns cross-nomic manifestation. A human contractual nomos is historically generated within human relational and symbolic histories, and its distinctions can be highly effective without acquiring ontological universality. Application to a heterogeneous nonhuman subject therefore requires a manifestation or translation relation whose typing and distinction preservation must be justified. A nomic-domain mismatch can arise before any meaningful above-threshold or below-threshold comparison is available. Ethical evaluation enters through an additional evaluative nomos: difference between human and nonhuman discrimination structures alone supplies no moral verdict.

The third limitation family concerns inter-nomic mediation. Two political, legal, linguistic, or institutional systems can each sustain coherent local contract formation while lacking a pre-given common interface for joint formation and recognition. The category-theoretic construction separates translation into an interface, contract formation within that interface, and recognition back into local systems. Commutative or naturally coherent diagrams provide a representation of compatibility among those routes. Missing interfaces, translation loss, divergent recognition, and generative asymmetry in interface formation can therefore produce cross-border limitations even when local contractual capacity is unproblematic.

These diagnoses share prior-nomos dependence while remaining formally non-reducible. Capacity analysis presupposes a sufficiently typed relation between subject horizon and contractual grammar. Cross-nomic manifestation asks whether that typing is warranted across heterogeneous relational systems. Inter-nomic mediation begins from locally articulated nomoi and asks whether a shared contractual interface can be generated and maintained. A single empirical case can combine the mechanisms, but none follows from the others by definition.

The reconstruction is diagnostic and requires separate normative premises for ethical, political, or legal evaluation. A contract-formative gap, distinction loss, noncommutation, or generative asymmetry identifies a structural relation that may matter under a specified ethical, political, or legal theory. Empirical application additionally requires evidence for the modeled histories, manifestations, conditions, translations, interfaces, and recognition practices. The conservative temporal representation used here preserves realized history while allowing later changes in manifestation and nomic significance; the deeper ontology of time remains suspended.

The paper therefore leaves a positive problem for subsequent work. Once social contract is understood as operating within historically generated manifestations and nomoi, ethical relations among heterogeneous subjects can no longer be assumed to begin from a common contractual grammar. Human–animal, human–AI, AI–AI, and possible future human–nonhuman relations raise the constructive question of how shared or mediating ethical nomoi might be generated when common manifestation, generative horizon, and contractual language are unavailable or only partial. The present paper supplies the diagnostic architecture on which that further inquiry can build.

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