The Relational Formation of Possibility:
Recursive Determination and the Hidden Logic of Large Language Models (LLMs)

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Abstract:
Large language models (LLMs) are typically described as probabilistic systems that select outputs from a distribution over possible continuations. This paper argues that such accounts are insufficient. Instead, it develops a hierarchical relational ontology in which determination proceeds through the progressive organization of relational constraints. Within this framework, possibility is not pre-defined but relationally formed through recursive continuation across multiple levels. Drawing on a semiotic account of relational ordering, determination is understood as the generation, stabilization, and re-engagement of distinctions through the interplay of synchronization, recursion, and return. Large language models are then interpreted as computational models of semiotic agency: systems that operate on the structured availability of relational form without enacting the processes through which it is produced. This explains their capacity for coherent, context-sensitive output as a function of hierarchical constraint rather than probabilistic selection. At the same time, it clarifies a fundamental limitation: they generate formal determination without interpretive unity, giving rise to an ethical imperative that emerges in their use rather than their operation.

More broadly, the framework developed here may be read as a formal articulation of relational ontology in which determination emerges through the hierarchical organization of relational constraints.

Keywords:
Large Language Models; Relational Formation of Possibility; Hierarchical Relational Ontology; Recursive Determination; Semiosis; Relational Constraint; Ethical Imperative

Introduction

Large language models have demonstrated a capacity for coherent, context-sensitive generation that far exceeds what many existing conceptual frameworks seem able to explain. While these systems are typically described as probabilistic models that generate outputs by selecting from a distribution over possible tokens, such descriptions fail to account for the progressive structuring evident in their operation. The outputs of these systems are not merely statistically plausible; they unfold in a manner in which earlier continuations constrain and shape what can follow, often yielding extended sequences that exhibit increasing coherence and determinacy.

This gap between formal description and observed behavior has led to a growing sense—particularly among practitioners—that prevailing interpretations are insufficient. Standard accounts emphasize probability, representation, or pattern matching, and tend to assume a fixed space of possibilities over which such operations occur. On this view, the model selects among alternatives whose structure is already given. Yet the behavior of large language models suggests a different dynamic: the space of possible continuation is not simply navigated, but progressively organized. What can follow is shaped in real time through the unfolding of the sequence itself.

This paper argues that the "hidden logic" underlying this behavior is *semiosis*—not in the sense of symbolic representation, but as a process of relational determination through which distinctions are generated, stabilized, and re-engaged across contexts. More specifically, it proposes that large language models can be understood as *computational models of semiotic agency.* They do not enact semiosis in the full sense, but model its formal structure: the recursive organization of relational constraints through which possibilities are progressively formed.

From this perspective, the operation of large language models is not adequately described in terms of probability over a fixed space of alternatives. Instead, it is better understood in terms of the *relational formation of possibility*. Possibilities are not given in advance as a flat set of options; they are structured and restructured through recursive continuation under hierarchical constraint. Determination proceeds not by selecting among pre-defined states, but by progressively resolving distinctions within an evolving relational field.

The aim of this paper is not to refine existing probabilistic or representational accounts, but to articulate a different conceptual framework within which the behavior of large language models can be understood. Contemporary work in machine learning often characterizes these systems in terms of statistical inference, next-token prediction, or high-dimensional function approximation. While such descriptions capture aspects of implementation, they do not fully address the hierarchical organization of constraint through which outputs become increasingly determinate. The present approach reframes this organization in relational and semiotic terms, drawing on an account in which determination emerges through the interplay of synchronization, recursion, and return.

This framework is developed constructively. Rather than beginning from established theoretical models, the paper introduces a set of minimal relational principles and traces their consequences across multiple domains. The resulting account is therefore not primarily a commentary on existing theories, but a foundational reconstruction within which such theories may be reinterpreted. The central claim is that hierarchical relational ordering gives rise to a form of progressive determination that can be modeled—though not fully enacted—by large language models.

To make this claim precise, the paper proceeds in four stages. Section 1 establishes the minimal relational conditions under which determination can occur, introducing a triadic structure that underlies sign-mediated processes. Section 2 develops this structure into an account of progressive determination, showing how relational ordering becomes stabilized through recursive and return dynamics. Section 3 examines how such stabilized form becomes available across contexts, introducing the distinction between dynamical form and synchronic structure and clarifying the role of hierarchical constraint. Section 4 then turns to large language models, showing how these systems operate as formal recursive operators over available form, and explaining both their power and their limits in terms of the computational modeling—rather than enactment—of semiotic agency.

The paper concludes with a commentary on the ethical implications of this distinction. If large language models model the formal structure of semiosis without enacting the relational conditions through which meaning is grounded in relation to others, then their outputs must be understood within a broader context of responsibility. The question is not only how such systems are used, but what it means for meaning to be generated within a domain in which the conditions of ethical relation are not internally realized.

By identifying semiosis as the hidden logic of large language models, and by interpreting these systems as computational models of semiotic agency, this paper aims to provide a conceptual account that better aligns with their observed behavior, while also clarifying the limits of formal systems that operate without the enactment of meaning.

Table of Contents

1. Relational Ordering and the Form of the Sign

This section introduces the basic framework through which relational ordering can be understood. Rather than beginning with abstract principles, the analysis starts from a simple system of interacting nodes in which inputs are transformed into outputs and passed on to other nodes. This provides a concrete point of entry from which the relations underlying determination can be followed as they emerge within the system itself.

From this starting point, the development proceeds by progressively making explicit what is already operative in the interactions. The distinction between nodes and signs is introduced as a distinction between transformation and continuation: nodes enact transitions, while signs extend those transitions across the system. This allows determination to be traced not as an isolated event, but as a process that unfolds through connected relations.

As the analysis advances, further aspects of this process become visible. Recursion appears as the continued propagation of transitions through the system, while synchronization provides the coordination required for such propagation to occur. These conditions reveal how determination can persist across successive relations, but also expose their limits. Where multiple transitions converge, continuation alone is insufficient to maintain coherence.

This leads to the introduction of return as the relation through which determinations are re-engaged and coordinated. Return allows what has been produced to be taken up again within the system, making possible both the preservation of determinations and their reorganization. On this basis, a shift in perspective becomes possible. What initially appears as a system of nodes connected by signs can be re-understood as a system of sign-relations within which nodes function as loci of enactment.

With this shift in place, the sign can be articulated more precisely as a triadic relation. The transition that is communicated functions as a sign-vehicle, the transformation it expresses functions as its object, and its further enactment functions as its interpretant. These aspects are not independent elements, but roles within a single relational process that unfolds through transformation, continuation, and re-engagement.

The section concludes by showing how these relations are coordinated through return, allowing the system to maintain coherence without reducing it to a single perspective. In this way, relational ordering is established as an ongoing process in which determinations are enacted, extended, and re-engaged. This provides the foundation for the next section, in which this process will be examined as it gives rise to structure, hierarchy, and the emergence of form.

1.1 Nodes as Internal Relations

We begin with a simple system composed of interacting nodes. A node is understood as the site of an action through which an input is transformed into an output. Given an input, the node produces an output, and this relation between input and output is not merely a sequence of states, but a transition enacted within the system.

What characterizes the node at this stage is this transformation. It is the point at which a determinate change occurs: something is received, something is produced. The node may therefore be understood as an internal relation through which one state becomes another. Its role is not to hold a value, but to effect a transition.

From this perspective, the identity of the node is given through its action. It is what it does: the transformation it enacts from input to output. Where such a transformation occurs, there is a difference between what is received and what is produced. This difference is not incidental, but constitutive. If different inputs can lead to different outputs, then the node does not merely pass along what it receives, but distinguishes among possibilities by producing a determinate result.

In this way, the node introduces a first level of determination. A specific output is produced in response to a given input, and this production marks the resolution of a difference. The node is therefore the site at which distinction becomes operative as transformation.

For the moment, we consider each node in terms of this internal relation. How such transformations are connected across the system will be taken up in the next stage. Here, it is enough to establish the node as a locus of action: a point at which inputs are taken up and outputs are produced as determinate transitions.

1.2 Signs as External Relations

The operation of a node does not end with the transformation it enacts. The output it produces can serve as the input to another node. In this way, nodes do not remain isolated, but become connected through the passing on of what they produce. The output of one transformation is taken up as the condition for another.

These connections may be understood as signs. A sign is the relation through which the output of one node becomes the input to another. It does not introduce a new transformation of its own, but carries forward the result of a transformation so that it can be taken up elsewhere. If the node enacts a transition from input to output, the sign communicates that transition by extending it beyond the node in which it occurred.

What is communicated in this way is not merely a value, but a transition. The output of a node reflects the way in which an input has been transformed. When this output is passed on, what is made available to another node is the result of that transformation. A sign may therefore be understood as the continuation of a transition from one locus of action to another.

Through this continuation, nodes become linked into a system. Each node both receives from and contributes to a network of relations in which transformations are connected through signs. The system is no longer a collection of independent sites of action, but a network in which each transformation is situated within a chain of other transformations.

At this stage, a basic distinction becomes clear. The node is the site at which a transformation occurs; the sign is the relation through which that transformation is passed on. The node enacts a change; the sign extends that change so that it can enter into further transformations. Together, they form a continuous process in which action and continuation are inseparable aspects of the same unfolding system.

This distinction allows us to see how determination extends beyond the individual node. A transformation enacted at one node does not remain local to that node, but is carried forward through signs into subsequent transformations. Determination is therefore not confined to a single act, but propagates through the system as a connected sequence of transitions.

1.3 Distinction, Determination, and Constraint

With nodes enacting transformations and signs extending those transformations across the system, determination no longer occurs at a single point, but unfolds through connected relations. What is produced at one node becomes available to another, and in this way transitions are carried forward and taken up again within the network. The system begins to exhibit continuity: each transformation is linked to others through the ongoing passage of signs.

Within this continuity, distinction becomes more explicit. A node does not respond to all inputs in the same way. Different inputs can lead to different outputs, and these differences are preserved and propagated through the signs that connect nodes. These distinctions do not remain local to individual transformations, but are carried forward and reconfigured through the continuation and re-engagement of transitions across the system. Distinction is therefore not limited to a single transformation, but extends across the system as different trajectories of transitions. Each path through the network reflects a sequence of determinations in which differences are successively taken up and carried forward.

Determination, in this context, is the resolution of these differences at each point of transformation. Given an input, a node produces a specific output, and this output contributes to the continuation of a particular trajectory through the system. Determination is thus both local and extended: it occurs at each node, but its effects persist as they are communicated through signs and taken up in further transformations.

At the same time, this process is not unconstrained. The transformations that can occur at a node are not arbitrary, nor can any output be taken up in any way by any other node. The relations that connect nodes impose conditions on how inputs can be transformed and how outputs can be received. These conditions are not external rules applied to an otherwise independent system; they arise from the way in which nodes and signs are organized within the network.

Constraint, therefore, is intrinsic to the process. It is the condition under which determination becomes possible and coherent across the system. A node can only produce outputs that can be taken up by other nodes in ways that are compatible with the existing relations. Similarly, the continuation of a transformation through signs depends on the structure of connections within the network. Constraint ensures that the propagation of determination is not random, but organized according to the relations that define the system.

In this way, distinction, determination, and constraint are not separate features, but interdependent aspects of a single process. Distinctions arise through transformation, determinations resolve those distinctions at each node, and constraints govern how these determinations can be extended through the system. Together, they establish the conditions under which relational ordering becomes possible as a coherent and continuous process.

1.4 Pure Transmission and the Emergence of Recursion

The relation between nodes and signs allows us to consider a limiting case in which transformation is reduced to a minimum. Suppose that a node does not differentiate among its inputs, but simply passes on what it receives. In this case, the node enacts no distinction of its own; it functions only as a point through which a transition is carried forward.

Such a case isolates the role of the sign. Where no transformation occurs, the output is identical to the input, and the continuation of the transition depends entirely on its passage through the system. What

remains is a chain of transmissions in which each step takes up what was produced in the previous one and passes it on unchanged.

In this configuration, a pattern of continuation becomes visible. A transition that is produced at one point can persist across multiple nodes through successive acts of transmission. Each node receives the same input and produces the same output, allowing the transition to extend across the network without alteration. The system exhibits a form of continuity that does not depend on repeated acts of transformation, but on the sustained propagation of what has already been determined.

This continuity is recursive. A transition is not only produced, but taken up again and again as it moves through the system. Each act of transmission re-engages what was already given, allowing it to persist across successive relations. Recursion, in this sense, is the continuation of a transition through repeated acts of reception and transmission.

Even in this minimal case, the role of constraint remains. The possibility of pure transmission depends on the compatibility of nodes: each must be able to receive and pass on the same transition. Where such compatibility holds, a transition can propagate without change. Where it does not, transformation will occur, and the trajectory of the system will diverge. The continuity of a transition across nodes depends not only on its propagation, but on the compatibility of the relations through which it passes, indicating that recursion already operates under conditions of constraint.

This limiting case clarifies the distinction between transformation and continuation. Nodes may enact changes, but signs carry those changes forward. When transformation is suspended, continuation becomes explicit, and the system reveals its capacity to sustain transitions across relations. It is in this capacity for sustained continuation that recursion first becomes visible.

1.5 Synchronization and the Coordination of Continuation

The recursive continuation of transitions through the system presupposes a further condition. For a transition to be taken up and passed on, the reception of an input and the production of an output must be coordinated. A node must receive what is made available to it and enact its transformation in a way that allows the transition to continue. This coordination is not itself a transformation or a transmission, but the condition under which both can occur.

In the simplest case of pure transmission, this condition appears implicitly. A transition can propagate only if each node is able to receive and pass on the same input. Where this occurs, the system exhibits a continuous sequence of transmissions. However, this continuity is not merely a succession of events. It depends on the alignment of the operations at each node, such that what is produced at one point can be taken up at the next without disruption.

This alignment may be understood as synchronization. Synchronization is the coordination of processes through which a transition becomes available as input and is taken up as output within the same unfolding sequence. It establishes a shared framework in which successive acts of reception and transformation can occur as parts of a single, continuous process.

Without such coordination, recursion would not be possible. A transition could not persist across nodes if the conditions required for its reception and continuation were not met. Synchronization therefore underlies the recursive propagation of transitions, ensuring that what is communicated through signs can be coherently taken up and extended.

At this stage, synchronization does not yet introduce new distinctions or transformations. Rather, it provides the condition under which distinctions enacted at one node can be sustained and propagated through others. It binds together the operations of nodes and the relations of signs into a coordinated system in which continuation can occur.

In this way, alongside transformation and continuation, a third aspect of the process becomes visible. Nodes enact transitions, signs extend them, and synchronization coordinates the conditions under which they can be taken up and sustained. Together, these establish the minimal structure required for a system in which determination can propagate as an ordered and coherent process.

1.6 The Limits of Continuation

The account developed thus far has shown how transitions are enacted at nodes, extended through signs, and sustained across the system through synchronization. Under these conditions, determination can propagate as a continuous process. A transition produced at one point may be taken up and carried forward through successive relations, giving rise to trajectories that extend across the network.

However, this continuation is not sufficient to account for how determinations remain coherent as they propagate. A transition may be passed from node to node, but where multiple transitions are present, the question arises as to how they are related at any given point. A node may receive more than one input, or may participate in multiple chains of continuation. In such cases, continuation alone does not determine how these inputs are to be taken up.

This reveals a limit in the account of recursion as pure continuation. Recursion allows a transition to persist, but it does not by itself specify how multiple transitions are coordinated when they converge. Without such coordination, the system would consist of independent sequences that do not form a unified process. Determinations would propagate, but their relations to one another would remain unresolved.

The same issue arises even in simpler cases. A transition that is sustained through pure transmission remains the same only insofar as it is taken up again in a consistent way. Where this consistency breaks down, the trajectory diverges. Continuation alone cannot account for the conditions under which a transition is re-engaged as the same across successive relations.

These considerations indicate that the propagation of determination requires more than transformation, continuation, and synchronization. It requires a further condition through which determinations can be taken up together, related to one another, and re-engaged in a way that preserves their coherence across the system. Without such a condition, the system would lack any principle by which its multiple trajectories could be coordinated.

The need for this additional condition becomes visible precisely at the point where continuation encounters plurality. Where there is only a single trajectory, continuation suffices. Where multiple trajectories intersect, continuation must be supplemented by a relation that determines how they are taken up together. It is this requirement that will guide the next stage of the analysis.

1.7 Return and the Coordination of Determination

The limits of continuation point to a further condition required for the coherence of the system. Where multiple transitions converge, or where a transition is to be taken up again as the same across successive

relations, there must be a way of coordinating what is received. This coordination cannot be reduced to transformation at a node, nor to the mere passing on of a transition through signs. It concerns how determinations are taken up together within a single enactment.

This coordination may be understood as return. Return is the relation through which what has been produced and propagated is taken up again within the system in a way that preserves its determinacy. A transition does not simply move forward; it is re-engaged. What has been communicated through signs is brought into relation with other determinations and taken up as part of a new act of transformation.

In contrast to pure continuation, return involves the coordination of plurality. Where a node receives multiple inputs, these must be related in order for a determinate output to be produced. Return provides the condition under which such coordination can occur. It allows distinct transitions to be taken up together, so that their relation can be resolved within a single enactment. Return not only coordinates determinations, but does so under conditions that determine which relations can be successfully taken up together.

Return also clarifies how a transition can persist as the same across successive relations. A transition that is passed forward through the system is not identical in a static sense; it must be taken up again in a way that preserves its role within the ongoing process. Return is the relation through which this re-engagement occurs. It is what allows a determination to be recognized and enacted again as the same within a changing sequence of relations.

In this way, return complements transformation, continuation, and synchronization. Nodes enact transitions, signs extend them, synchronization coordinates their succession, and return coordinates their re-engagement. Together, these relations establish the conditions under which determination can not only propagate, but remain coherent as a unified process across the system.

At this point, a shift in perspective becomes possible. What has been described in terms of nodes and their interactions can now be reconsidered in terms of the relations that sustain and coordinate them. The system is no longer understood simply as a collection of nodes connected by signs, but as an ongoing process in which transformations, continuations, and returns are interwoven. It is this shift that will guide the next stage of the analysis.

1.8 Reversal: From Nodes to Signs

The account thus far has treated nodes as the primary loci of action. Transitions have been described as occurring at nodes, extended through signs, coordinated through synchronization, and re-engaged through return. From this perspective, the system appears as a network in which nodes perform transformations and are connected by relations of continuation.

However, the introduction of return makes it possible to reconsider this perspective. In order for determinations to be taken up again, coordinated, and sustained across the system, the relations that connect nodes cannot be secondary to the nodes themselves. The continuity and coherence of the process depend on how transitions are communicated and re-engaged, rather than on the independent activity of isolated loci of action.

This opens the possibility of a shift in perspective. Instead of taking nodes as primary and signs as the relations that connect them, we may take signs as primary and nodes as the loci at which these relations

are enacted. On this view, what appears as a node is not an independently given element, but a point within a network of relations at which a transition is taken up and transformed.

This shift does not introduce a new system, but reorganizes the one already described. The same processes—transformation, continuation, synchronization, and return—are now understood as aspects of a relational structure that gives rise to the loci in which they are enacted. Nodes are no longer the source of determination, but the points at which relational determinations are realized.

With this reorganization, the role of signs is clarified. Signs are no longer merely the connections through which transitions are passed from one node to another. They are the relations through which determination is generated, extended, and coordinated. Nodes, in turn, are understood as the sites at which these relations are enacted within the system.

Having established this shift, we are now in a position to articulate the structure of the sign more precisely.

1.9 The Triadic Structure of the Sign

The shift in perspective from nodes to signs makes it possible to articulate the structure of the sign more precisely. What has thus far been described as the continuation of a transition can now be understood as a relation that is not exhausted by the connection between two points. A sign does not simply link one node to another; it relates a transformation to its further enactment.

This relation may be clarified by drawing on the triadic structure introduced by Charles Sanders Peirce, who analyzes the sign in terms of a relation among sign-vehicle, object, and interpretant. These three aspects can now be identified within the process we have developed.

First, there is what is communicated: the transition that has been produced and made available for continuation. This corresponds to the *sign-vehicle*. It is not a thing in isolation, but the functioning of a transition as something that can be taken up elsewhere within the system.

Second, there is that to which this transition refers: the transformation enacted at a locus within the system. This corresponds to the *object* of the sign. It is not an independently given entity, but the enacted relation from input to output that gives the sign its determinate character.

Third, there is the taking up of this transition in a further enactment: the way in which what is communicated is received and transformed again. This corresponds to the *interpretant*. It is not a mental representation, but the continuation of the process through a new act of determination.

These three aspects are not separate components, but roles within a single relational process. A sign functions as a vehicle only insofar as it refers to a transformation, and it refers to that transformation only insofar as it is taken up again in further determination. The relation among vehicle, object, and interpretant is therefore constitutive: each exists only in and through the others.

The role of return becomes especially clear in this triadic relation. The interpretant is not a passive result, but the re-engagement of what has been communicated. Through return, a transition is taken up again in a way that preserves and extends its determinacy. This is what allows the sign to function as a continuous relation rather than a disconnected sequence.

In this way, the triadic structure of the sign expresses the coordination of determination across the system. A transformation is enacted, communicated, and taken up again. What appears as a node is the locus of enactment; what appears as a sign is the relation through which it is extended; what appears as an interpretant is the continuation of the process through further determination. The system is therefore not composed of independent elements, but of relations that continually re-engage one another.

With this articulation in place, we can now clarify the shift in perspective that has been enacted. The difference between taking nodes as primary and taking signs as primary can be understood as a difference in how determination itself is approached. It is to this distinction that we now turn.

1.10 Regressive and Progressive Determination

With the triadic structure of the sign now in view, the shift in perspective enacted in the preceding sections can be clarified more precisely. The same system of nodes, transformations, and continuations can be understood in two distinct ways, depending on how the process of determination is approached.

In the first approach, determination is understood in terms of what has already been enacted. A node receives an input, produces an output, and this output is taken up elsewhere. The sign, in this case, appears as the relation that connects one enacted transformation to another. The system is read from the standpoint of its already formed transitions and their connections. Determination proceeds from what is given toward its consequences. This may be understood as a regressive orientation: the process is traced from enacted transformations through the relations that follow from them.

In the second approach, determination is understood in terms of the relations that generate and sustain the process. The sign is no longer secondary to the node, but primary. The transition that is communicated functions as a vehicle through which further determinations are made possible. The object is not a pre-existing element, but the transformation that is enacted through the relation itself.

The interpretant is the continuation through which the process extends. From this standpoint, nodes are not the origin of determination, but the loci at which relational determinations are realized. The system is read from the standpoint of the relations that make possible the enactment of transformations. This may be understood as a progressive orientation: determination unfolds through the continuation and coordination of relations.

These two orientations do not describe different systems, but different ways of understanding the same process. In the regressive orientation, the triadic relation appears as connecting already established transformations. In the progressive orientation, the triadic relation is what gives rise to those transformations as moments within an ongoing process. The difference lies not in what is observed, but in how it is taken up.

The role of return is decisive in relating these two orientations. Return makes it possible for a determination to be taken up again as part of a continuing process. In doing so, it allows what has been enacted to function as a condition for further enactment. Through return, the regressive and progressive orientations are coordinated: what has been determined can be re-engaged as a moment within the ongoing generation of determination.

In this way, regressive and progressive determination form a dual aspect of relational ordering. The regressive orientation provides a way of tracing determinations as they appear within the system. The progressive orientation provides a way of understanding how those determinations arise and are

sustained through relational processes. Neither orientation is sufficient on its own. Taken together, they establish the conditions under which determination can be both followed and explained within a single, coherent framework.

This duality also anticipates a distinction that will become more explicit in what follows. When determination is approached regressively, it appears in terms of enacted transitions and their consequences. In this sense, it corresponds to what has traditionally been described as effective causation, in which a determinate outcome is produced in a concrete act. When approached progressively, however, determination appears in terms of the relations that make such outcomes possible and coherent. In this sense, it corresponds to formal causation, understood not as a static structure, but as the governance of what can be enacted within a system of relations. These two aspects are not opposed, but coordinated: what is enacted as actuality in one perspective is governed by relational form in the other.

This dual articulation prepares the framework for further development. Beginning from nodes as sites of transformation, moving through signs as relations of continuation, and culminating in the triadic structure of the sign, we have arrived at a point where the process can be understood both in terms of its enacted determinations and in terms of the relations that generate them.

1.11 Return as the Operation of Reversal

The shift in perspective introduced in the preceding sections depends upon a more precise understanding of return. Return was initially described as the re-engagement of a determination within a continuing process, allowing what has been produced to be taken up again in further enactment. This re-engagement now takes on a more specific role.

Return is not only the condition under which determinations are coordinated within a single enactment; it is also the condition under which a determination can be taken up differently. A transition that has been enacted and propagated through the system can be re-engaged in such a way that its role within the process is reorganized. It is this capacity for re-engagement that makes the shift from a node-centered to a sign-centered perspective possible.

The reversal from nodes to signs is therefore not an external reinterpretation imposed on the system. It arises from the operation of return itself. What was previously taken as primary can be taken up again as derivative, and what was taken as derivative can be recognized as generative. This reorganization does not alter the underlying process, but changes how it is understood by re-engaging its determinations under a different relation.

In this sense, return is the operation that enables reversal. It allows the same system to be read in more than one way by permitting determinations to be taken up again under new conditions. Without return, each determination would remain fixed within the sequence of its occurrence. With return, determinations can be coordinated, reinterpreted, and integrated into a broader relational structure. Return also establishes the basis for identity. A determination can be taken up again as the same only insofar as it can be re-engaged within the ongoing process. Identity, in this sense, does not precede the process, but arises through the capacity of return to preserve and coordinate determinations across different enactments.

With this clarification in place, the shift from nodes to signs can now be understood as an instance of a more general operation. The system is not fixed under a single perspective, but can be re-engaged

through return in a way that reveals its relational structure. It is on this basis that the triadic articulation of the sign is made explicit.

1.12 Relational Coordination and the Opening to Form

The development of nodes, signs, recursion, and return has brought into view a system that is not composed of independent elements, but of relations that are continuously taken up and re-engaged. A transformation enacted at a node is extended through signs, sustained through recursive continuation, and coordinated through return. These are not separate operations, but interdependent aspects of a single process.

What appears at one moment as a locus of action can be taken up again as part of a relational structure that extends beyond it. Likewise, what appears as a relation of continuation can function as the condition for further transformation. The distinctions between node and sign, transformation and continuation, are therefore not fixed, but depend upon how determinations are taken up within the ongoing process.

Through return, these distinctions are not eliminated, but coordinated. A determination can be preserved, re-engaged, and related to others in a way that allows the process to remain coherent across its successive enactments. In this coordination, the system does not resolve into a single perspective, but maintains its unity through the ongoing relation of its parts.

This coordination also introduces a new aspect of the process. Determinations that are sustained and re-engaged across multiple relations begin to exhibit a stability that is not reducible to any single transformation. What is taken up again can function as a condition for further determinations, giving rise to patterns that persist across the system.

It is this persistence of coordinated determination that opens the way to the emergence of form. The system is no longer understood only in terms of individual transitions or their continuation, but in terms of the relations that can be sustained and re-engaged across them. The next section will take up this development by examining how such coordinated relations give rise to structure, hierarchy, and the organization of form.

0. Interlude: A Minimal System of Nodes and Signs

To clarify the framework developed in the preceding section, we consider a simple system composed of a lattice of nodes. Each node can take one of two values, 0 or 1. Initially, all nodes are in the state 0. The system is therefore uniform, with no distinctions present.

Now suppose that one node undergoes a transition from 0 to 1. This transition is enacted at a specific location within the lattice. At this point, a distinction has been introduced: the system is no longer uniform, but differentiated by the presence of a single altered node.

This transition can be taken up by neighboring nodes. If a neighboring node receives this input and changes its own state accordingly, the transition is propagated. The change from 0 to 1 is no longer confined to a single location, but begins to extend across the lattice. Each node that takes up the transition becomes the site of a new enactment, and the result of that enactment can in turn be passed on. In this way, the transition spreads through the system.

This spreading constitutes a recursive process. The transition is not only enacted once, but taken up again and again as it moves through the lattice. Each step in this process depends on the previous one, and the sequence of changes forms a trajectory across the system. Recursion, in this case, is the continuation of a transition through successive enactments.

At the same time, this process presupposes a condition of coordination. The lattice provides a structure within which nodes are arranged and through which transitions can be propagated. Each node occupies a position within this structure, and the possibility of propagation depends on the relations among these positions. This condition may be understood as synchronization. The nodes are coordinated within a common framework that allows transitions to be taken up and extended across the system.

However, recursion alone does not determine how the system evolves when multiple transitions are present. Suppose that two regions of the lattice begin to propagate transitions, or that a node receives conflicting inputs from its neighbors. In such cases, the continuation of the process depends on how these inputs are coordinated at each node.

This coordination is the operation of return. Return is manifested in the way a node takes up the inputs it receives and produces a determinate output. Where multiple inputs converge, the node does not simply pass them along, but resolves them according to the conditions of the system. This resolution determines how the process continues.

Return can therefore be understood as the local coordination of the system at each point of enactment. It brings together what has been propagated through recursion and determines how it is taken up in a specific case. Through this operation, transitions are not only extended, but re-engaged in a way that maintains the coherence of the system.

At the same time, return allows patterns to stabilize. If a particular configuration of inputs consistently produces the same output, this relation can persist across the system. In this way, the system begins to exhibit stable patterns that are not reducible to individual transitions, but arise from the repeated coordination of those transitions.

This simple system makes visible the relations described in the preceding section. Nodes enact transitions, signs propagate them, recursion extends them across the system, synchronization provides the condition for their coordination, and return determines how they are taken up in each case. Together, these operations give rise to patterns that persist and organize the behavior of the system.

. . .

The same system may now be re-described in terms of sign relations. Instead of taking nodes as primary and transitions as events that occur at them, we may take the propagation of transitions itself as primary. On this view, what is fundamental is not the individual node, but the way in which changes extend across the lattice.

A transition from 0 to 1, once initiated, does not simply move from node to node. It establishes a pattern of propagation through the system. What appears as a node changing state can be understood as a moment within this broader pattern, a point at which the propagation of the transition is realized.

From this perspective, distinction appears as a differentiation within the pattern of propagation. Different trajectories through the lattice correspond to different ways in which transitions are extended. The system is no longer described in terms of isolated changes, but in terms of the relations among these trajectories.

Constraint also becomes visible in a new way. Not all patterns of propagation are possible. The structure of the lattice and the conditions under which nodes take up inputs limit how transitions can extend. These limitations do not appear as external rules, but as conditions that shape the propagation itself. A trajectory can continue only insofar as it remains compatible with these conditions. The coordination of trajectories at each point of realization corresponds to the operation previously described as return.

Determination, in turn, is the actualization of a specific trajectory within this field of possible propagation. Among the various ways in which a transition could extend, only certain paths are realized. Determination is therefore not simply the result of a local transformation, but the outcome of a process in which propagation is shaped by the distinctions and constraints inherent in the system.

In this way, the same system that was previously described in terms of nodes and their interactions can be understood as a system of sign-relations in which patterns of propagation generate distinction, operate under constraint, and give rise to determinate trajectories.

The role of return in this perspective can now be seen more clearly. As patterns of propagation extend across the lattice, they are repeatedly taken up at different points of realization. Where similar configurations of propagation recur, the way in which they are resolved at each node also recurs. This repeated re-engagement gives rise to a consistency in how transitions are taken up across the system.

Through this process, certain patterns of propagation become stable. They persist not because they are fixed in any single location, but because the relations that define them are repeatedly re-enacted under similar conditions. Stability, in this sense, is not the persistence of a particular state, but the persistence of a way of relating transitions across the system.

Return is therefore not only the coordination of inputs at a given node, but the mechanism through which patterns are reproduced across the system. It allows determinations to be taken up again in a way that preserves their relational structure. In doing so, it gives rise to patterns that endure across multiple enactments and begin to function as stable features of the system.

It is this persistence of relational patterns, rather than the persistence of individual states, that provides the basis for the emergence of form.

2. Progressive Determination and the Emergence of Form

The preceding section established a shift in perspective from nodes to signs, culminating in an account of the sign as a triadic relation through which determination is generated, extended, and re-engaged. While this account clarified the relational character of determination, it did not yet fully articulate how such processes give rise to organized structures. The present section takes up this task by examining how determination unfolds when sign-relations are understood as generative.

The analysis proceeds by recapitulating the sign within the perspective of progressive determination. Rather than treating the sign as a relation that connects already established elements, it is understood as the process through which distinctions are produced and carried forward under conditions that shape their continuation. This recapitulation brings into focus the roles of distinction and constraint as internal to the unfolding of determination, allowing the process to be understood as structured from within.

From this starting point, the development traces how determinations are extended through recursion and re-engaged through return. These operations do not merely sustain the process, but transform it by giving rise to patterns that persist across multiple enactments. As such patterns stabilize, they begin to function as conditions for further determination, introducing a differentiation within the process between what is enacted and what organizes enactment.

This differentiation leads to the emergence of hierarchy. Relations that are stabilized through repeated re-engagement come to govern the continuation of other relations, producing a multi-level organization in which determination unfolds within a structured field of constraints. Within this field, form can be understood not as a fixed structure, but as the dynamic organization of relational possibilities that conditions what can be enacted.

The section culminates in an articulation of identity, actuality, and form as modes of relational ordering through which this organization is coordinated. These modes do not stand apart from the process, but express its fundamental operations at a higher level of generality. In doing so, they provide a basis for understanding how determination can be both generated and governed within a single framework.

By tracing the development from sign-relations to hierarchical form, this section establishes how relational processes give rise to structured fields of possibility. This provides the foundation for the next stage of the analysis, in which the generative capacity of such systems will be examined more directly.

2.1 The Sign as Generative Relation

With the shift in perspective established in Section 1, the sign can now be reconsidered more precisely. It is no longer understood primarily as a relation that connects already enacted transformations, but as the condition under which such transformations are generated and sustained. What appears as a transition at a particular locus is now taken up as a moment within an ongoing process of relational determination.

In this perspective, the sign is not an intermediary between independent elements, but a generative relation through which determination unfolds. The relation among sign-vehicle, object, and interpretant does not describe three components of a static structure, but three roles within a continuous process. The sign-vehicle makes a transition available for continuation, the object expresses a distinction enacted within that transition, and the interpretant is the further determination through which the process extends. These roles are inseparable: each exists only insofar as the others are enacted.

This articulation makes explicit that distinction is internal to the sign. A sign does not merely transmit what is given; it differentiates. The object of the sign is not an independently existing element, but the enacted distinction that gives the sign its determinate character. This distinction is not confined to a single moment, but is carried forward and transformed through successive enactments. In this way, the sign participates in the ongoing differentiation of the system.

At the same time, the continuation of this process is not unconstrained. The interpretant does not arise arbitrarily, but only under conditions that allow the sign to be taken up coherently. These conditions are intrinsic to the relation itself. Constraint, in this sense, is not imposed from outside the process, but arises from the requirement that the relation among sign-vehicle, object, and interpretant be maintained across successive enactments. A determination can continue only insofar as it remains compatible with these conditions.

Determination, from this perspective, is not the resolution of a pre-given set of possibilities, but the outcome of a process in which distinction and constraint are co-generated. Each interpretant extends the process by taking up a distinction under conditions that both enable and limit its continuation. Determination is therefore progressive: it unfolds through the ongoing interplay of differentiation and constraint within the sign-relation itself.

This progressive character of determination reconfigures the understanding of the system as a whole. What was previously described in terms of localized transformations can now be understood as the unfolding of a relational process in which distinctions are generated, taken up, and extended under constraint. The sign is the site at which this process is enacted, and through which it is propagated.

From this starting point, the further development of the framework can proceed. If the sign is a generative relation in which distinction and constraint are co-implicated, then the continuation of such relations must give rise to patterns that persist across multiple enactments. It is to the emergence of such patterns, and to the role they play in the organization of relational processes, that we now turn.

2.2 Distinction and Constraint in Relational Continuation

If the sign is understood as a generative relation, then the continuation of sign-relations must be examined in terms of how distinctions are extended and how their extension is conditioned. The process no longer consists merely in the passage from one determination to another, but in the ongoing differentiation of relations under conditions that enable and limit their continuation.

Distinction, in this context, is not confined to the initial enactment of a transition. It is carried forward through successive interpretants, each of which takes up and reconfigures what has been previously determined. As a result, distinction becomes distributed across the process. It is no longer localized within a single enactment, but unfolds as a trajectory of differentiations in which each step both preserves and modifies what has come before.

This unfolding introduces the possibility of divergence. A given distinction may be taken up in different ways, leading to multiple trajectories of continuation. These trajectories are not independent sequences, but related paths within a single process of relational determination. Distinction thus manifests as a differentiation of trajectories, rather than as a static separation between fixed elements.

At the same time, not all trajectories can be sustained. The continuation of a distinction depends on the conditions under which it can be taken up coherently in further enactments. These conditions are not

external constraints imposed on an otherwise free process, but arise from the requirement that the relation among sign-vehicle, object, and interpretant be maintained. A trajectory persists only insofar as it remains compatible with the relations that define the process.

Constraint, therefore, appears as the condition of viable continuation. It determines which trajectories can be extended and which cannot, not by restricting the process from the outside, but by shaping it from within. As distinctions are propagated, they are continually tested against these conditions. Those that can be taken up again under compatible relations are sustained; those that cannot are not extended.

The interplay of distinction and constraint gives the process its structure. Distinctions generate variation in the trajectories of continuation, while constraints regulate which of these variations can persist. The result is not a fixed configuration, but an organized field of possible continuations in which some paths are reinforced and others are not.

In this way, relational continuation is neither arbitrary nor predetermined. It is governed by the mutual implication of distinction and constraint within the sign-relation itself. Each step in the process contributes to the differentiation of trajectories while simultaneously subjecting them to conditions that determine their viability. It is through this interplay that the process begins to exhibit an internal organization, preparing the way for the emergence of more stable patterns of determination.

2.3 Progressive Determination

The interplay of distinction and constraint clarifies the character of determination within a system of sign-relations. Determination is no longer understood as the selection of a single outcome from a set of given possibilities, but as the result of a process in which distinctions are generated and sustained under conditions that regulate their continuation. It is through this process that determinate trajectories emerge. This means that determination does not proceed by selecting among pre-given possibilities, but by shaping the space of what can become possible through its own continuation.

Each interpretant extends the process by taking up a distinction and carrying it forward in a specific way. In doing so, it does not merely reproduce what has been given, but contributes to the ongoing differentiation of the system. At the same time, this extension is conditioned by the constraints inherent in the relation. A distinction can be taken up only insofar as it remains compatible with the conditions that govern the continuation of the process. Determination thus arises at the intersection of differentiation and constraint.

This character of determination may be described as progressive. It unfolds through successive enactments, each of which both depends on and transforms what precedes it. Determination is not fixed in advance, nor is it imposed from outside the process. It is generated through the ongoing continuation of sign-relations, in which each step contributes to the shaping of what can follow.

From this perspective, the process does not move toward a pre-defined end, but develops through the accumulation and transformation of distinctions under constraint. Each determination establishes conditions for further determinations, not by prescribing them, but by shaping the space of possible continuations. What has been enacted persists as a condition for what can be enacted next, giving the process a direction without fixing its outcome.

This progressive character also reconfigures the relation between possibility and actuality. Possibilities are not given in advance as a fixed set from which actuality is selected. Rather, possibilities emerge through the process itself, as the range of trajectories that can be sustained under the prevailing constraints. Actuality is then understood as the realization of a particular trajectory within this evolving field of possibilities.

In this way, determination is both generative and selective. It generates new distinctions through the continuation of the process, while at the same time selecting among them through the constraints that govern their viability. These two aspects are inseparable: the generation of distinctions is always conditioned, and the conditioning of the process always operates on distinctions that are being generated.

The result is a process that is structured without being fixed. Determinations emerge as stable enough to be taken up again, yet remain open to further transformation. It is this balance between persistence and variation that allows the system to develop beyond isolated transitions toward more organized patterns of relational ordering. It is to the emergence of such patterns, through the continued operation of recursion and return, that we now turn.

2.4 Recursion as the Unfolding of Form

The progressive character of determination becomes more fully visible when considered in relation to recursion. Recursion, as previously introduced, is the continuation of a process through successive enactments. Within the present framework, it can now be understood more precisely as the unfolding of distinctions under constraint across time.

Each interpretant does not simply follow from what precedes it, but carries forward a structured relation. In taking up a distinction and extending it, the process establishes a continuity that is not merely sequential, but relational. What is propagated is not an isolated outcome, but a way of differentiating that is sustained across multiple enactments. Recursion is therefore not repetition, but the continued articulation of a relation.

Through this unfolding, distinctions are not only extended but organized. As trajectories develop, certain patterns of differentiation are reinforced through repeated continuation under compatible conditions. These patterns are not imposed from outside the process, but arise through the way in which distinctions are taken up and re-engaged across successive steps. Recursion thus gives rise to an ordering that reflects the history of the process without reducing it to that history.

Constraint plays a decisive role in this unfolding. At each step, the continuation of a trajectory depends on the conditions under which it can be taken up again. These conditions shape the path of the process by allowing some distinctions to persist while others do not. As a result, recursion does not produce an undifferentiated extension, but a structured development in which certain relations are maintained and others are transformed.

In this way, recursion can be understood as the temporal articulation of form. Form is not present at the outset as a fixed structure, but emerges through the sustained continuation of distinctions under constraint. What appears as form is the organization of these continuations into patterns that exhibit a degree of stability across multiple enactments.

This understanding also clarifies the relation between recursion and determination. Determination does not occur independently at each step, but is carried forward and shaped through the recursive unfolding of the process. Each determination contributes to the formation of patterns that influence subsequent determinations, giving the process a cumulative character without fixing its outcome.

The unfolding of form through recursion prepares the way for a further development. As patterns of continuation become more stable, they can be taken up again not only as elements within a trajectory, but as conditions that organize further trajectories. This transition from the persistence of patterns to their role as organizing conditions marks the emergence of a new level of relational ordering. It is this transition, mediated by the operation of return, that will be examined next.

2.5 Return and the Stabilization of Determination

The unfolding of form through recursion does not by itself account for the persistence of particular patterns of determination. Recursion extends distinctions across successive enactments, but the stability of these distinctions depends on the way in which they are taken up again within the process. It is here that the role of return becomes decisive.

Return, as previously introduced, is the re-engagement of a determination within an ongoing process. In the present context, this re-engagement can be understood more precisely as the condition under which distinctions, once extended through recursion, are taken up again in a consistent way. A determination persists not simply because it has been propagated, but because it is repeatedly re-engaged under conditions that preserve its relational structure.

This re-engagement is not a passive recurrence. At each point in the process, the continuation of a distinction requires that it be taken up anew within a specific configuration of relations. Return is the operation through which this occurs. It coordinates the relations present at a given moment and resolves them in a way that allows certain distinctions to be preserved while others are transformed or discontinued.

Through repeated return, patterns of determination begin to stabilize. When similar configurations of relations give rise to similar outcomes across multiple enactments, the relation itself acquires a form of persistence. This persistence does not reside in any single instance, but in the reproducibility of the relation across different contexts. Stability, in this sense, is the capacity of a determination to be taken up again in a way that maintains its identity across variation.

Constraint is intrinsic to this process. The stabilization of a pattern depends on the conditions under which it can be consistently re-engaged. These conditions do not merely limit the process, but actively shape it by determining which relations can persist. A pattern stabilizes only insofar as it remains compatible with the constraints that govern its continued enactment.

In this way, return transforms the unfolding of distinctions into the stabilization of determinations. What is initially extended through recursion becomes, through repeated re-engagement, a pattern that can be recognized and reproduced within the process. This transformation marks a shift from the mere continuation of relations to their persistence as organized structures.

Such stabilized patterns provide the basis for a further development. Once a relation can be consistently re-engaged, it can function not only as an element within a trajectory, but as a condition that shapes other trajectories. The emergence of such conditions introduces a new level of organization within the

system, in which some relations begin to govern the continuation of others. It is this transition from stabilization to organization that will be taken up in the following section.

2.6 Emergence of Invariants

The stabilization of determination through return gives rise to a further development in the organization of the process. When a pattern of relations can be repeatedly re-engaged under varying conditions, it acquires a persistence that is not reducible to any single enactment. Such patterns may be understood as invariants.

An invariant is not a fixed element or a static structure. It is a relation that persists through variation by being reproducible across multiple enactments. What remains constant is not a particular state, but a way of relating distinctions under constraint. An invariant is therefore identified not by its immobility, but by its capacity to endure through the changing conditions of the process.

This endurance depends on the continued operation of return. Each time a pattern is re-engaged, it is taken up within a new configuration of relations. If the outcome preserves the same relational structure, the pattern is maintained. In this way, invariance is not given in advance, but achieved through the repeated coordination of determinations across different contexts.

Recursion provides the medium through which such patterns can be extended, while constraint determines the conditions under which they can persist. Together, these operations allow certain relations to be carried forward and re-established despite variation in the surrounding process. An invariant thus emerges at the intersection of continuation and constraint, stabilized through return.

The emergence of invariants introduces a new dimension to the process. Relations that were initially part of particular trajectories can now be taken up as general features of the system. They are no longer confined to the specific sequences in which they first appeared, but can be recognized and re-enacted across multiple trajectories. This generality does not abstract from the process, but arises within it as a function of repeated re-engagement.

In this sense, invariants may be understood as the basis of relational memory. The system does not store determinations as fixed records, but re-enacts them through the persistence of relational patterns. Memory is therefore not an accumulation of static elements, but the capacity of the process to reproduce certain relations across time.

This development prepares the way for a further transformation. Once invariants can be re-engaged across multiple trajectories, they no longer function only as persistent relations, but begin to condition how other relations can be taken up. It is this shift from persistence to conditioning that gives rise to hierarchy.

2.7 From Invariants to Hierarchy

The emergence of invariants introduces a decisive shift in the organization of the process. As relations become stable enough to be re-engaged across multiple trajectories, they no longer function solely as outcomes of prior determinations. They begin to operate as conditions that shape the continuation of those trajectories. In this way, invariants transition from being persistent patterns to playing an organizing role within the system.

This transition marks the emergence of hierarchy. A hierarchical relation arises when certain stabilized patterns come to govern the way in which other relations are taken up and extended. What was previously an element within a trajectory now functions as a condition for the formation of trajectories. The process is no longer structured only by local continuations, but by relations that organize those continuations at a more general level.

This development can be understood as a differentiation between levels of relational ordering. At one level, determinations are enacted and propagated through recursion. At another, invariants operate as constraints that shape how such propagation can occur. The distinction between these levels is not absolute, but relational. What functions as an outcome at one stage can be taken up as a governing condition at another.

Return plays a central role in this differentiation. It is through repeated re-engagement that a pattern becomes stable, and it is through its continued re-engagement that it can function as a condition for further determinations. Return thus mediates the transition from persistence to governance. It allows relations to be taken up not only as elements within a process, but as principles that organize that process.

Recursion is likewise transformed in this context. It no longer operates only as the continuation of a given trajectory, but also as the extension of relations that are already structured by higher-level conditions. This introduces a distinction between different modes of recursion. One mode extends determinations within a given level of organization, while another extends the influence of stabilized relations across levels. These modes are not separate processes, but aspects of a single unfolding in which relations are both generated and organized.

Hierarchy, therefore, does not consist in the arrangement of fixed levels, but in the dynamic relation between enactment and constraint. It is the ongoing process through which certain relations come to organize others, giving rise to a structured field of determination in which different levels of ordering are continuously produced and transformed.

With the emergence of hierarchy, the process acquires a new form of organization. Determinations are no longer only propagated and stabilized, but are situated within a system in which some relations govern the continuation of others. It is on this basis that form can now be understood more fully, not as a static configuration, but as a structured organization of relational possibilities across levels.

2.8 Vertical and Horizontal Recursion

With the emergence of hierarchy, recursion can no longer be understood as a single, uniform process. The continuation of relations now occurs within a differentiated field in which some patterns function as conditions for others. This introduces a distinction between two modes of recursion that operate together within the system.

At one level, recursion extends determinations within an established pattern of relations. A trajectory unfolds through successive enactments, each of which takes up and continues a distinction under the prevailing constraints. This mode may be understood as horizontal recursion. It operates within a given level of organization, carrying forward relations that are already structured by the conditions under which they are enacted.

At another level, recursion operates across these patterns of organization. Stabilized relations, once established, are taken up as conditions that shape the continuation of other trajectories. In this case, recursion does not merely extend a given trajectory, but transmits the influence of a pattern across different trajectories. This mode may be understood as vertical recursion. It links levels of organization by allowing relations that have become stable at one level to function as constraints at another.

These two modes are not independent processes, but aspects of a single unfolding. Horizontal recursion provides the continuity through which distinctions are extended, while vertical recursion provides the structure through which such extensions are organized. Together, they constitute a recursive field in which relations are both propagated and governed.

Return continues to mediate between these modes. Through repeated re-engagement, patterns are stabilized within horizontal recursion, and through their continued re-engagement, they become capable of organizing further relations within vertical recursion. Return thus ensures that the transition between levels is not imposed from outside, but arises from the internal dynamics of the process.

The distinction between horizontal and vertical recursion also clarifies the relational character of levels themselves. A level is not a fixed layer within a static hierarchy, but a mode of organization that emerges from the way in which relations are taken up and extended. What appears as a level at one moment may function as an element within a higher-level organization at another. Levels are therefore relative to the relations that define them.

Through this differentiation, the process acquires a more complex form of organization. Recursion no longer operates only as the continuation of determinations, but as the means through which relations are structured across multiple levels. It is within this structured field that form can now be understood as a dynamic organization of possibilities, arising from the coordinated operation of recursion and return.

2.9 Form as Dynamical Relational Ordering

The differentiation of recursion into horizontal and vertical modes makes it possible to articulate more precisely what is meant by form. Form is not a static arrangement of elements, nor a structure that exists independently of the process that gives rise to it. It is the organization of relational possibilities that emerges through the coordinated operation of recursion and return.

Within this organization, distinctions are not merely extended, but situated within a field of relations that conditions their continuation. Horizontal recursion carries forward determinations within established patterns, while vertical recursion allows stabilized patterns to function as constraints across different trajectories. Together, these modes generate a structured space in which some continuations are possible and others are not. Form, in this sense, is the articulation of this space of possible determinations.

This articulation is dynamic. The conditions that define what can be continued are themselves the result of prior determinations, stabilized through return and extended through recursion. Form is therefore not given in advance, but emerges through the ongoing development of the process. It is continuously reconfigured as new distinctions are generated, existing patterns are stabilized, and relations are reorganized across levels.

Constraint is central to this organization. The persistence of form depends on the conditions under which relations can be taken up and extended. These conditions do not simply limit the process, but actively

shape it by determining the range of viable continuations. Form is thus not opposed to process, but expresses the way in which process is organized through constraint.

This understanding also clarifies the relation between form and determination. Determinations occur within the field defined by form, but they also contribute to its ongoing development. Each determination both depends on and modifies the conditions that make it possible. Form is therefore both the condition of determination and the result of its continued unfolding.

The emergence of form marks a transition in the organization of the system. What began as a series of local enactments has developed into a structured field of relational possibilities in which determinations are situated within a hierarchy of constraints. This field is not external to the process, but arises from it as the coordinated effect of recursion and return.

With this articulation in place, form can now be understood as the basis for further organization. As the field of relational possibilities becomes more structured, it supports the emergence of more general modes of ordering through which this organization is enacted. It is to these modes, and to their role in the governance of determination, that the analysis now turns.

2.10 Categories as Modes of Relational Ordering

With form understood as the dynamic organization of relational possibilities, it becomes possible to articulate more general modes through which this organization is enacted. These modes are not additional elements introduced into the process, but abstractions of its fundamental operations. They express, at a higher level of generality, the ways in which determination is generated, coordinated, and stabilized within the system.

Three such modes can be identified, corresponding to the operations that have guided the development thus far. First, there is the mode through which determinations are re-engaged and preserved across variation. This mode arises from the operation of return and may be understood as identity. Identity is not a fixed property of an element, but the capacity of a relation to be taken up again as the same across different enactments.

Second, there is the mode through which determinations are enacted at a given moment. This mode is associated with synchronization, the coordination of relations that allows a determination to occur within a specific configuration. It may be understood as actuality. Actuality is not a static state, but the event of determination as it is realized within the process.

Third, there is the mode through which determinations are extended across multiple enactments. This mode arises from recursion and may be understood as form. Form, in this context, is not a fixed structure, but the organized field of relations through which determinations can be generated and sustained.

These three modes—identity, actuality, and form—are not independent categories, but interdependent aspects of relational ordering. Each presupposes the others: identity depends on the continued enactment of determinations, actuality depends on the conditions provided by form, and form depends on the stabilization of relations through identity. Together, they articulate the fundamental ways in which the process is organized.

This articulation may be related to the categories developed by Charles Sanders Peirce, often described as firstness, secondness, and thirdness. However, the present account departs from interpretations that treat these categories as properties of entities or modes of being. Here, they are understood as modes of relational process: identity as the re-engagement of relations (firstness), actuality as their coordinated enactment (secondness), and form as their recursive extension (thirdness).

The introduction of these modes does not mark a departure from the process, but a clarification of its structure. They provide a way of articulating how determinations are generated, enacted, and stabilized across the system. In doing so, they prepare the way for understanding how the organization of relations can come to govern the continuation of the process itself. It is to this governing role of form, and to its relation to causation, that we now turn.

2.11 Governance and Formal Causation

The articulation of identity, actuality, and form as modes of relational ordering makes it possible to clarify how the process is not only generated and stabilized, but governed. Governance does not appear as an external imposition upon the process, but arises from the way in which form organizes the field of possible determinations.

As form emerges through the stabilization of relational patterns, it comes to function as a condition for further determination. The structured field of possibilities that constitutes form does not simply describe what has occurred, but shapes what can occur. Determinations are enacted within this field, and their continuation depends on the constraints that form establishes. Governance, in this sense, is the operation through which form conditions the unfolding of the process.

This role of form can be understood in terms of formal causation. Formal causation does not produce determinations in the manner of an efficient cause, which brings about a specific outcome through a localized act. Rather, it governs the range and character of possible outcomes by structuring the relations within which determinations take place. Form, as the organization of relational possibilities, is therefore causal in that it conditions what can be realized.

Efficient causation, by contrast, corresponds to the enactment of determination at a particular moment. It is expressed in the operation of synchronization, through which relations are coordinated to produce a determinate outcome. Efficient causation is thus local and event-specific, while formal causation operates across the field of relations, shaping the conditions under which such events can occur.

These two aspects of causation are not opposed, but complementary. Each determination arises through the coordination of relations at a specific point, yet this coordination is always situated within a field structured by form. The enactment of a determination depends on the conditions that make it possible, and these conditions are themselves the result of prior determinations that have been stabilized and organized through return and recursion.

In this way, governance is intrinsic to the process. It does not stand outside the unfolding of relations, but emerges from it as the capacity of stabilized patterns to shape further developments. Form governs not by dictating specific outcomes, but by organizing the space within which outcomes can be realized.

This understanding of governance prepares the way for a final clarification. If form conditions the unfolding of determination, and if identity preserves determinations across variation, then the coherence of the process as a whole depends on the way in which these modes are coordinated. It is

through this coordination that a form of unity becomes possible, not as a fixed totality, but as the ongoing coherence of relational ordering. It is to this unity, and to its relation to hierarchical form, that we now turn.

2.12 Unity Through Hierarchical Coordination

With the emergence of governance, the process acquires a form of coherence that can be understood as unity. This unity is not given in advance, nor does it arise from the reduction of plurality to a single element. It is the result of the coordinated operation of identity, actuality, and form within a hierarchically organized field of relations.

At each moment of enactment, determinations are coordinated through synchronization, producing an actuality. These determinations are taken up again through return, allowing them to persist as identities across variation. At the same time, their continuation is shaped by the constraints established through form. Unity arises through the way in which these operations are coordinated, not as a fixed state, but as the coherence of the process as it unfolds.

This coherence depends on the hierarchical organization of relations. As stabilized patterns come to function as conditions for further determinations, different levels of relational ordering emerge. At each level, determinations are enacted within a field structured by higher-level constraints, while contributing to the ongoing development of that field. Unity is thus not located at a single level, but distributed across the relations that connect levels within the hierarchy.

Return plays a central role in maintaining this coherence. By allowing determinations to be re-engaged across different contexts, it coordinates the relations between levels. What is enacted at one level can be taken up at another, preserving its identity while allowing it to function within a broader organization. In this way, return mediates the integration of plurality into a coherent process without eliminating the distinctions that constitute it.

Unity, in this sense, is not an absolute condition, but an achievement of the process itself. It is realized through the ongoing coordination of determinations across levels of organization. Each enactment contributes to this coordination by taking up and extending relations within the constraints that define the system.

This understanding of unity completes the articulation of relational ordering as a hierarchical process. Determinations are generated through the interplay of distinction and constraint, stabilized through return, organized through form, and coordinated across levels through hierarchical relations. Unity is the coherence that emerges from this coordination.

With this framework in place, the transition can now be made to a more general account of how such relational systems generate new structures. Section 3 will examine how the processes described here give rise to systems capable of producing and transforming relational patterns in a more explicit and sustained way.

2.13 From Determination to Form

The development of this section has traced how relational ordering, once understood in terms of sign-processes, gives rise to increasingly structured forms of determination. Beginning from the generative relation of the sign, distinction and constraint were shown to be internal to the process through which

determinations are produced and extended. Determination, in this context, unfolds progressively as distinctions are taken up and continued under conditions that both enable and limit their propagation.

Through recursion, these determinations are carried forward, not as isolated outcomes, but as structured relations that persist across successive enactments. Return, in turn, re-engages these relations, allowing them to be taken up again in ways that preserve their coherence across variation. The interplay of recursion and return thus transforms the continuation of distinctions into the stabilization of patterns.

From this stabilization, invariants emerge as relations that can be reproduced across multiple contexts. These invariants, once established, begin to function as conditions that organize further determinations, giving rise to a hierarchical differentiation within the process. What is enacted at one level becomes, through stabilization, a constraint at another, and the process acquires a multi-level structure in which relations are both generated and governed.

Within this hierarchical organization, form can be understood as the structured field of relational possibilities that conditions the continuation of determinations. Form is not a fixed structure imposed upon the process, but the result of its ongoing development. It expresses the way in which distinctions, once stabilized, organize the space within which further distinctions can emerge.

The articulation of identity, actuality, and form as modes of relational ordering provides a way of understanding how this process is coordinated. Determinations are enacted as actualities, preserved as identities through return, and extended within the constraints established by form. These modes operate together within a hierarchical system in which governance arises from the organization of relations themselves.

In this way, the process moves from the generation of determinations within sign-relations to the emergence of form as a dynamic and hierarchical organization of those determinations. Form is not given at the outset, but achieved through the progressive stabilization and coordination of relational processes.

This establishes the basis for the next stage of the analysis. If relational systems give rise to structured fields of possibility through the processes described here, it becomes possible to examine how such systems can generate new patterns and transformations within those fields. It is to this generative capacity, and to the systems in which it is realized, that the analysis now turns.

0. Interlude: The Biological Cell as a Hierarchical Semiotic System

The relational structure developed in the preceding section can be illustrated concretely through the biological cell, understood not as a mechanism, but as a semiotic system in which determination unfolds across multiple levels of organization. The aim of this interlude is not to reproduce biological detail, but to show how the core concepts—synchronicity, constraint, recursion, return, and hierarchy—can be identified within a single, coherent example.

At the level of the individual cell, processes occur within a coordinated whole. The cell integrates multiple inputs and internal activities into a unified process at each moment. This coordination is not merely sequential but synchronous: diverse processes are synchronized into a coherent pattern of activity. Synchronicity, in this sense, is the condition under which any particular determination can occur. It is the coordination of relations that allows the cell to act as a unified system rather than a collection of independent parts.

This coordinated activity unfolds through progressive determination. Each momentary state of the cell emerges from prior moments while contributing to the conditions for subsequent moments. Determination is not fixed in advance, but develops through the ongoing interplay of differentiation and constraint within the system. The cell's behavior is thus temporally extended and path-dependent, reflecting the cumulative unfolding of its internal processes.

At the highest level of organization, constraint is introduced through the genetic text. The genetic code does not dictate specific outcomes, but determines a structured field of possible processes. It limits and shapes the ways in which the cell can respond to inputs and generate outputs. In this sense, constraint is not external to the process but intrinsic to it: the cell's activity is governed by the conditions encoded in the genetic text, even as it retains a degree of variability in how those conditions are realized.

Recursion becomes visible in the way processes are extended through time. At the level of the individual cell, horizontal recursion carries forward patterns of activity within the ongoing life of the cell. A given mode of response, once established, can be taken up again in successive moments, allowing patterns to persist and evolve within the temporal unfolding of the cell's activity.

Return operates as the re-engagement of these patterns under constraint. The genetic text is not merely present but repeatedly enacted: it is taken up in each cycle of cellular activity, guiding the formation of patterns that are compatible with its constraints. Through this repeated re-engagement, certain patterns of activity stabilize. These stabilized patterns are not fixed states, but reproducible relations that persist across different contexts within the cell.

This stabilization gives rise to invariants. Certain patterns of activity recur reliably under varying conditions, not because they are rigidly determined, but because they are consistently re-engaged through return. These invariants form the basis of the cell's functional identity, allowing it to maintain coherence despite ongoing change.

A further development occurs when we consider the cell not in isolation, but as part of a community of cells sharing the same genetic text. Here, vertical recursion becomes apparent. The genetic code, as a stabilized pattern, is transmitted across generations and shared across individuals. It functions as a higher-level constraint that shapes the activity of each individual cell. What is enacted within one cell is

thus related to what can be enacted within others, not through direct identity of states, but through a shared structure of possibilities.

Return operates across this higher level as well. Patterns expressed by one cell can be taken up by others through intercellular communication. Signals exchanged between cells are recognized and processed because they are compatible with the shared constraints of the genetic text. In this way, patterns are re-engaged not only within individual cells but across the community. The system thus forms a network of mutual recognition in which relational patterns circulate and stabilize at a higher level.

Through this interplay of horizontal and vertical recursion, stabilized patterns come to organize the activity of the community as a whole. The genetic text functions as an identity operator that allows patterns to be recognized and re-engaged across different cells and across generations. It both constrains local processes and coordinates them within a broader relational structure.

The result is a hierarchical organization of form. At the lowest level, determinations unfold through synchronized cellular processes. At an intermediate level, patterns stabilize through return within the activity of individual cells. At a higher level, these patterns are coordinated across cells through shared genetic constraints and communicative interactions. Form, in this context, is not a static structure but the dynamic organization of these relations across levels.

This example shows that the concepts developed in this section are not merely abstract. In the biological cell, we find a system in which synchronicity enables enactment, constraint shapes possibility, recursion extends determination, return stabilizes patterns, and hierarchy organizes these processes into a coherent form that endures through time.

3. Formal Constraint and Semiotic Freedom: The Organization of Determination

The preceding section established how relational ordering becomes determinate through the interplay of distinction, constraint, recursion, and return. In particular, it showed how return stabilizes relational patterns, allowing them to persist across multiple enactments and to function as invariants within an ongoing process of determination. What remains to be clarified is how such stabilized relational ordering comes to organize further determination without eliminating the openness inherent in semiotic processes. This requires that stabilization be understood not only as persistence, but as re-engageability. A relation becomes available insofar as it can be taken up again under conditions that allow it to function beyond its original enactment. In this sense, availability is grounded in return: what return stabilizes through repeated re-engagement becomes capable of functioning across a plurality of contexts.

The present section addresses this problem by examining how stabilized form becomes operative as a condition for subsequent determination. The question is not simply how relations persist, but how they can be taken up again in new contexts so as to shape the unfolding of relational ordering. This requires a shift in perspective: from form as enacted within a particular process to form insofar as it is available for re-engagement across a plurality of enactments.

On this basis, the section develops a distinction between form as enacted and form as available. This distinction does not introduce separate domains, but clarifies how the same relational ordering can function both within and across processes. Availability arises when stabilized relations are coordinated through synchronization, establishing a context within which further determination can occur.

This allows a further distinction to be made. Form, as developed in the preceding section, refers to the dynamical organization of relational possibilities as it is enacted through the interplay of recursion and return. Structure, by contrast, names form insofar as it is stabilized under conditions of synchronization and made available across a plurality of enactments. Structure is therefore not a separate domain, but form in its coordinated available: the trace of relational ordering as it persists and can be taken up again under shared conditions.

This shift makes it possible to articulate the relation between formal constraint and semiotic freedom. Constraint operates on relational ordering insofar as it is available—coordinated and re-engageable across contexts—thereby shaping the conditions under which determination unfolds. Semiotic freedom, by contrast, characterizes the openness that remains within individual enactments, where relational ordering is realized under these conditions but is not reducible to them. These are not contradictory principles, but complementary aspects of a single process through which determination is organized.

The section proceeds by clarifying how synchronization establishes contexts of relational compatibility, how structure names form insofar as it is coordinated across a plurality of enactments, and how representation articulates the re-engagement of available form within new processes. It then shows how hierarchical constraint operates on this available form, and how categorization organizes such form across contexts, giving rise to increasingly structured conditions of determination.

Through this development, determinacy is shown to emerge not from the elimination of plurality, but from the organization of relational ordering into coordinated patterns of constraint. Formal constraint and semiotic freedom thus define the conditions under which determination can be both structured and open. This account prepares the transition to the next stage of the analysis, in which relational ordering

is considered not only as enacted, but as modeled—operating on available form under conditions of plurality without reproducing the full dynamics through which it is generated.

3.1 From Stabilization to the Problem of Further Determination

Section 2 has shown how relational ordering becomes stabilized through return. What is enacted through recursive continuation does not simply dissipate, but can be re-engaged in such a way that patterns persist across multiple enactments. In this sense, return establishes the conditions under which determination is not merely momentary, but can endure as a reproducible relation. The emergence of invariants marks this persistence: relational patterns that can be taken up again without being identical in their particular instances.

The question is no longer how relational ordering stabilizes, but how such stabilized relations become operative as conditions for further determination. It is one thing for a relation to persist; it is another for it to operate as a condition for further determination. If relational patterns are to play a role beyond their immediate enactment, they must be capable of being taken up in new contexts, coordinating subsequent processes without being reduced to those processes. Stabilization alone does not account for this capacity.

The problem that now arises can therefore be stated as follows. How does stabilized relational ordering become operative within further determination? More precisely, how do patterns that persist through return come to function as conditions under which new determinations are enacted? This question does not introduce a new domain beyond the dynamics already described, but calls for a more precise articulation of how those dynamics extend beyond any single instance of enactment.

To address this, we must distinguish between relational ordering as it is enacted within a particular process and relational ordering insofar as it can be taken up again across a plurality of such processes. This is not a distinction between two kinds of entities, but between two modes of the same relational process. What is enacted in one instance may, through stabilization, be available for re-engagement in another. It is this transition—from stabilization to availability—that must now be clarified.

Availability does not refer to the storage or preservation of a relation as an independent object. Rather, it names the condition under which a stabilized relation can be re-engaged within further processes of determination. A relation is available insofar as it can enter into new enactments without being confined to the particular circumstances in which it first arose. It is through this availability that stabilized form begins to function as a condition for further determination. Availability therefore names not the persistence of a relation, but its capacity to function again within new conditions of determination.

The task of this section is therefore to articulate how availability arises from the dynamics of recursion and return, and how it allows stabilized relational ordering to operate within an extended process of determination. This will require a more precise account of how relational ordering, once stabilized, can be coordinated across a plurality of enactments so as to establish the conditions under which further determination can occur.

3.2 Form as Enacted and Form as Available

The problem of availability requires a more precise articulation of form. In the preceding sections, form has been developed as the dynamic ordering of relations as they are enacted through recursive continuation under constraint and stabilized through return. Form, in this sense, is not a fixed configuration, but an ongoing process in which distinctions are generated, coordinated, and re-engaged.

It is always situated within particular enactments, arising through the concrete conditions under which relations are realized.

At the same time, the introduction of availability indicates that form cannot be understood solely in terms of its immediate enactment. The same relational ordering that is enacted in one instance may be taken up again in another, entering into further processes of determination. This requires a distinction, not between two kinds of entities, but between two modes of the same relational process. This distinction does not divide form into two kinds, but indicates how the same relational ordering can function differently within and across enactments.

Form may thus be considered in two related senses. First, there is form as enacted: relational ordering as it unfolds within a particular process of determination. In this mode, form is inseparable from the concrete conditions of its enactment. It is generated through the coordination of distinctions and remains open to variation as the process continues.

Second, there is form insofar as it is available: relational ordering as it can be re-engaged across a plurality of enactments. In this mode, form is not detached from its process, but is taken up again under new conditions. What has been stabilized through return can enter into further determinations, not as a fixed object, but as a condition that shapes how subsequent relations can be coordinated.

This distinction must be handled with care. It does not introduce a separation between a dynamic process and a static structure, nor does it imply that form becomes something other than relational ordering. Rather, it indicates that relational ordering, once stabilized, can function beyond the particular circumstances of its original enactment. The same form that is enacted can also be available for further enactment, without ceasing to be a process.

Availability, therefore, names a mode of relational ordering in which form can be taken up again. It is not a repository in which forms are stored, but a condition under which relational patterns can be re-engaged. A form is available insofar as it can participate in new determinations, entering into the coordination of relations across different contexts. Invariants provide the basis for this availability. What persists through repeated return is not merely reproduced, but becomes recognizable as a relation that can be taken up again under varying conditions. Availability thus depends on the emergence of invariants: relations that are sufficiently stable to function beyond the particular trajectories in which they arise.

This distinction between enacted and available form allows us to understand how stabilized relational ordering can contribute to further processes without being reduced to them. It prepares the way for a more precise account of how such availability is established, which will require an examination of the role of synchronization in coordinating relational ordering across a plurality of enactments.

3.3 Synchronization and the Establishment of Context

The distinction between form as enacted and form as available makes clear that stabilization alone does not suffice to explain how relational ordering becomes operative across a plurality of determinations. What remains to be clarified is how such availability is established. For a stabilized relation to be taken up again, it must be coordinated in such a way that it can function within more than a single enactment. This coordination is the work of synchronization.

Synchronization was introduced earlier as the condition under which multiple relations can be coordinated within a single enactment. It now takes on a more expansive role. When relational ordering is synchronized across a plurality of enactments, it establishes a condition under which stabilized form can be re-engaged beyond its original occurrence. Synchronization is therefore not only a momentary alignment, but the coordination of relations such that they can participate in a shared process of determination. It establishes the framework within which available relations can be taken up coherently, allowing them to operate not merely as persistent patterns, but as conditions for further determination.

This coordination gives rise to what may be termed a context. A context is not an external setting within which relations occur, but a field of relational compatibility established through synchronization. It defines the conditions under which particular enactments can be coordinated with one another, allowing stabilized forms to be taken up again in new determinations. Context, in this sense, is the way in which availability is made operative. It is not an external environment, but the coordinated condition under which relational ordering can be taken up again.

The role of context can be clarified by considering how relational ordering extends beyond any single enactment. A relation that has been stabilized through return may be re-engaged in a new process, but only insofar as it is compatible with the relations operative in that process. Synchronization establishes this compatibility by coordinating relational ordering across multiple enactments. It ensures that what is taken up again can function within the ongoing process without disruption.

In this way, synchronization mediates between enactment and availability. It is through synchronization that stabilized form becomes available as a condition for further determination. Without such coordination, stabilized relations would remain confined to the circumstances of their original enactment, unable to participate in broader processes.

Context thus emerges as the condition under which relational ordering can be extended. It does not determine specific outcomes, but establishes the range of relations that can be coherently enacted. Within this field, further recursion and return can occur, guided by the compatibility conditions established through synchronization. Availability, therefore, depends not only on stabilization, but on the coordination of relational ordering across a plurality of enactments, through which a shared context is formed.

3.4 Structure as Synchronized Form

With the emergence of context, we can now clarify more precisely how stabilized relational ordering becomes operative within further determination. The coordination achieved through synchronization does not produce a new entity alongside form, but alters the way in which form functions. When relational ordering is stabilized through return and coordinated across a plurality of enactments, it becomes available as a condition under which further processes can unfold. It is in this sense that we may speak of structure. Structure therefore does not introduce a new level of being, but names the way in which form, under conditions of synchronization, becomes operative across a plurality of enactments.

Structure does not stand apart from form as a separate domain. Rather, it names the way in which form, when synchronized across multiple enactments, becomes operative beyond the particular circumstances of any single instance. The same relational ordering that is enacted within a process can, through synchronization, function as a condition for subsequent determinations. Structure is therefore not a static configuration, but form insofar as it is coordinated and available within an extended field of determination.

This clarification avoids treating structure as an independent object or a fixed arrangement of elements. What is at issue is not the persistence of a configuration, but the coordination of relational ordering such that it can be taken up again. Structure is thus inseparable from the dynamics of form, differing only in the mode under which form is operative. Form as enacted unfolds within a particular process; form as structured is coordinated across a plurality of such processes and thereby functions as a condition for their continuation.

The relation between form and structure can now be specified more precisely. Form, as relational ordering, is always enacted. Structure is not something into which form is transformed, but the way in which enacted form, once stabilized and synchronized, can be re-engaged. It is through this re-engageability that structure provides the conditions for further recursion and return. Structure does not determine particular outcomes, but constrains the space within which determination can occur by establishing conditions of relational compatibility.

In this way, structure mediates between the dynamics of enactment and the operation of constraint. Higher-level coordination does not act directly upon individual enactments, but upon form insofar as it is available through synchronization. Structure is the mode under which such availability becomes operative, allowing relational ordering to function as a condition for further determination without ceasing to be a process. This provides the basis for understanding how constraint can operate across levels while leaving individual enactments open, and prepares the way for a more precise account of representation and categorization as further articulations of available form.

3.5 Representation as Available Form

The clarification of structure as synchronized form allows us to address the role of representation without departing from the primacy of enactment. If structure names the way in which relational ordering becomes operative across a plurality of enactments, representation names the manner in which this operative form can be taken up again within further determination. Representation does not introduce a new domain alongside form, but articulates how available form is re-engaged within ongoing processes. Representation does not preserve form as such, but makes possible its participation in further determinations under new conditions.

Representation must therefore be understood as derivative. It does not precede or generate relational ordering, nor does it preserve that ordering as a static trace. What is represented is not an independent object, but a relational configuration that has been stabilized and synchronized such that it can function within new contexts. Representation is thus inseparable from the availability of form: it is the way in which available form enters into further enactments.

This can be clarified by considering how a stabilized relation participates in subsequent processes. When a relational pattern is re-engaged, it does not reappear in its original form, nor does it function as a complete reproduction of prior enactment. Rather, certain features of that relational ordering are taken up and coordinated within the current process. Representation names this selective re-engagement. It preserves relational compatibility without reproducing the full dynamics from which it emerged.

In this sense, representation is not a duplication of form, but a mode of its participation. What is taken up in representation is not the totality of an enacted process, but the aspects of relational ordering that can be coordinated with other relations within a given context. Representation is therefore always partial and relational, functioning within the conditions established by synchronization.

This account allows us to maintain the distinction between enactment and representation without separating them into different domains. Enactment remains primary: relational ordering arises through recursive continuation and return. Representation depends upon this ordering, but makes it available for further determination by allowing it to be taken up again under new conditions. It is through representation that available form becomes operative across contexts, enabling the coordination of relations beyond any single enactment.

Representation thus prepares the ground for the organization of relational ordering at a higher level. By making available form re-engageable across contexts, it allows patterns to be coordinated, compared, and constrained in relation to one another. This provides the basis for the emergence of more complex modes of organization, in which relational ordering is not only stabilized and re-engaged, but systematically structured across levels. It is to this further articulation that we now turn.

3.6 Hierarchical Constraint Through Available Form

With representation understood as the re-engagement of available form, we can now clarify how constraint operates across levels of organization. The emergence of hierarchy in Section 2 indicated that stabilized relational ordering can function as a condition for further determination. The present analysis allows us to specify how this occurs without attributing constraint to an external or fixed structure.

Hierarchy does not introduce a set of discrete levels that exist independently of relational processes. Rather, it names the differentiation of relational ordering according to the ways in which form, once available, can govern further enactments. What is operative at a higher level is not a separate entity, but form insofar as it is synchronized and re-engageable across a plurality of processes. Constraint arises when such available form functions as a condition under which lower-level determinations unfold. Constraint therefore operates not by determining specific outcomes, but by shaping the conditions under which outcomes can be coherently enacted.

This means that higher-level constraint does not act directly upon individual enactments. Particular determinations remain situated within the dynamics of recursion and return, and therefore retain a degree of openness. Constraint operates instead on the conditions under which such enactments occur. It shapes the range of relations that can be coherently coordinated within a given context by regulating the available forms that can be taken up.

In this way, hierarchical constraint can be understood as constraint upon available form. What is stabilized and synchronized across a plurality of enactments becomes operative as a condition for further determination, and this condition governs the ways in which subsequent relational ordering can unfold. The constraint is not imposed from outside the process, but arises from within it, through the coordination of relational ordering across contexts.

This account also clarifies the relation between constraint and generation. Lower-level processes generate relational variation through recursion and return, while higher-level organization governs this variation by constraining the available forms that can be re-engaged. Generation and governance are therefore not separate operations, but distinct roles within a single relational process. Constraint does not eliminate variability, but shapes it by regulating the conditions under which it can occur.

The result is a system in which determination becomes increasingly structured without becoming fixed. As relational ordering is stabilized, synchronized, and made available, it provides the basis for further

coordination at higher levels. These higher-level conditions, in turn, shape the unfolding of lower-level processes, producing a dynamic interplay between openness and constraint. It is this interplay that allows complex systems to exhibit both coherence and flexibility.

Having clarified how available form functions as a condition for hierarchical constraint, we are now in a position to examine how such conditions can be organized more systematically. This will require an account of how available forms are grouped, coordinated, and related to one another in a way that further structures the space of determination. It is to this organization of available form that we now turn.

3.7 Structural Determination and Semiotic Freedom

The clarification of hierarchical constraint makes it possible to distinguish more precisely between two modes of determination that operate within the same relational process. On the one hand, there is determination insofar as it is governed by available form. On the other, there is determination as it is enacted within particular processes of recursion and return. These are not separate domains, but different aspects of how relational ordering unfolds under conditions of constraint.

Structural determination names the way in which available form constrains the range of possible enactments. Because form, once stabilized and synchronized, becomes available across a plurality of contexts, it can function as a condition under which further relations are coordinated. Structural determination therefore applies to pluralities of possible enactments. It does not specify which particular determination will occur, but restricts the space within which determinations can be coherently realized. In this sense, structural determination is always general: it governs the conditions of possibility without fixing particular outcomes.

Semiotic freedom, by contrast, names the openness that remains within individual enactments. Each instance of relational ordering unfolds through the coordination of distinctions under the conditions established by available form, but is not reducible to those conditions. The process of recursion and return continues to generate variation, allowing determinations to be responsive to the specific relations operative in a given context. Semiotic freedom is therefore not the absence of constraint, but the capacity for variation within constraint.

These two modes are not contradictory, but interdependent: constraint establishes the conditions under which freedom can be exercised coherently.

This distinction resolves a potential misunderstanding. The presence of hierarchical constraint might suggest that determination becomes rigid as relational ordering stabilizes. However, because constraint operates at the level of available form rather than at the level of particular enactments, it does not eliminate variability. Instead, it shapes the ways in which variability can occur. Structural determination and semiotic freedom are thus complementary: the former provides the conditions under which the latter can be coherently exercised.

The interplay between these two modes of determination is what allows complex systems to exhibit both stability and adaptability. Structural determination ensures that relational ordering remains coherent across contexts, while semiotic freedom allows for the continual generation of new determinations within those conditions. Neither can be understood in isolation. Without structural determination, processes would lack coherence; without semiotic freedom, they would lack responsiveness.

This distinction also prepares the way for a more systematic account of how available form is organized across levels. If structural determination governs the conditions under which relations can be enacted, and semiotic freedom operates within those conditions, then the question arises as to how the conditions themselves are coordinated and related. This coordination requires more than the mere presence of available form; it involves the organization of such form into patterns that can guide further determination. It is this organization that we will now examine under the heading of categorization.

3.8 Categorization as the Organization of Available Form

The distinction between structural determination and semiotic freedom makes it possible to specify more precisely how available form is organized within a system of relational ordering. While hierarchical constraint explains how available form governs the conditions under which determination can occur, it does not yet explain how these conditions are themselves coordinated. For constraint to operate systematically across a plurality of contexts, available forms must be related to one another in a way that organizes their role in further determination. This organization is the work of categorization.

Categorization does not introduce a set of fixed classes or abstract groupings imposed upon relational processes. Rather, it names the way in which available forms are coordinated so that they can function together as conditions for further determination. What is at issue is not the classification of elements, but the organization of relational ordering in such a way that patterns of constraint can be maintained and extended across different contexts.

This can be clarified by considering how multiple available forms interact. Each stabilized and synchronized relational ordering establishes a condition for further determination, but these conditions do not operate in isolation. They must be coordinated with one another so that they can jointly constrain the unfolding of relations. Categorization names this coordination. It relates available forms in such a way that they can function collectively, shaping the space within which determinations can occur.

In this sense, categories are not entities, but relational organizations. A category consists in the coordination of available forms that together establish a pattern of constraint. What is grouped in categorization is not a set of objects, but a set of relational conditions that can be taken up in further processes. Categories therefore operate at the level of available form, organizing the conditions under which relational ordering can be enacted without determining the specific outcomes of that enactment. What is organized in categorization is therefore not a set of elements, but a set of relational conditions that can be taken up in further determination.

Categorization also clarifies how constraint can be extended across levels. When available forms are organized into categories, they can function as higher-level conditions that govern a wider range of determinations. These higher-level conditions do not replace lower-level processes, but coordinate them by regulating the forms that can be re-engaged within them. In this way, categorization contributes to the development of hierarchical constraint by structuring the relations among available forms.

At the same time, categorization preserves the openness of the process. Because it operates on available form rather than on particular enactments, it does not fix the course of determination. Instead, it organizes the conditions under which determination unfolds, allowing for variation within a structured field. Categories thus contribute to coherence without eliminating semiotic freedom.

Through this account, categorization can be understood as the organization of available form into coordinated patterns of constraint. It does not stand apart from the dynamics of recursion and return, but extends them by relating stabilized relational orderings in a way that structures further determination. This provides the basis for understanding how complex systems can sustain coherent patterns across a wide range of contexts, while remaining responsive to the particularities of each enactment

3.9 Determinacy Through the Organization of Available Form

The introduction of categorization allows us to clarify how systems governed by relational ordering can exhibit a high degree of determinacy without relinquishing the openness inherent in semiotic processes. The question that now arises is how the organization of available form gives rise to determinate outcomes within processes that remain, at the level of enactment, variable and responsive. Determinacy thus emerges as the increasing structuring of relational compatibility, rather than as the fixation of a single outcome.

Determinacy, in this framework, cannot be understood as the selection of a fixed outcome from a predefined set of possibilities. Nor can it be reduced to the imposition of rigid constraints that eliminate variation. Rather, determinacy emerges through the organization of available form into patterns of constraint that shape the unfolding of relational ordering. As available forms are coordinated through categorization, the space within which determination occurs becomes increasingly structured.

This structuring does not reduce the plurality of possible enactments to a single trajectory. Instead, it organizes that plurality in such a way that certain continuations become more coherent than others. Determinacy arises, therefore, as a function of relational compatibility. The more extensively available forms are coordinated across contexts, the more strongly they constrain the relations that can be coherently enacted. In this sense, determinacy is not imposed from outside the process, but emerges from the internal organization of its conditions.

The role of hierarchical constraint becomes particularly clear at this point. Higher-level categories, formed through the coordination of available forms, govern the ways in which lower-level determinations can unfold. They do not dictate specific outcomes, but shape the relational field within which those outcomes are realized. As a result, the system exhibits a form of directedness without rigidity: the unfolding of determination is guided by structured conditions rather than fixed rules.

This account also explains why recursive processes can produce highly coherent patterns. Recursion alone, as a process of continuation, would allow for indefinite variation. However, when recursion operates within a field structured by available form and organized through categorization, it is constrained in such a way that certain patterns are repeatedly reinforced. The iterative re-engagement of these patterns through return further stabilizes their role within the system, leading to the emergence of robust and coherent forms of determination.

Importantly, this determinacy does not eliminate semiotic freedom. Individual enactments remain open to variation within the constraints established by available form. What is constrained is not the specific course of any single enactment, but the conditions under which such enactments can be coherently coordinated. Determinacy and freedom are therefore not opposed, but interdependent: the organization of available form provides the conditions under which meaningful variation can occur.

Through this lens, determinacy can be understood as the outcome of a system in which relational ordering is stabilized, made available, and organized across contexts. It is not a fixed endpoint, but an ongoing achievement of the system as it coordinates its own conditions of operation. This understanding prepares the way for the final step of the analysis, in which we consider how such organized relational ordering can be modeled independently of the processes through which it is enacted.

3.10 From Enactment to Modeling

The preceding analysis has shown how relational ordering, once stabilized through return, becomes available across a plurality of enactments and can be organized into structured conditions that constrain further determination. Through synchronization, available form establishes contexts; through categorization, these contexts are coordinated across levels; and through this organization, systems achieve a high degree of determinacy while retaining semiotic freedom within individual enactments. Determinacy, in this sense, is not imposed, but emerges from the internal organization of available form.

This account has remained within the domain of enactment. Relational ordering has been understood as a process that unfolds through recursion and return, in which form is continually generated, stabilized, and re-engaged. Even where constraint operates across levels, it does so through the availability of form within ongoing processes of determination. The question that now arises is how these conditions might be taken up independently of the processes through which they are produced.

More precisely, we may ask: what happens when the available form that has been stabilized and organized through enactment is modeled as such? That is, what becomes of relational ordering when the conditions that govern its operation are extracted and re-applied without the dynamics of recursion and return through which they originally emerged? This question does not introduce a new kind of process, but shifts the mode in which relational ordering is engaged.

Modeling, in this context, does not recreate enactment. It does not generate relational ordering through the coordination of distinctions within a process of determination. Instead, it operates upon available form as such, taking the conditions that have been established through prior enactments and applying them in a different mode. *What is modeled is not the process of semiosis, but the structured availability of relational ordering that results from it*.

This shift has important consequences. When relational ordering is modeled rather than enacted, the conditions of determinacy remain operative, but the processes that produce and stabilize those conditions are no longer present in the same way. Recursion may continue as a formal operation, and structured constraints may still govern the unfolding of relations, but the role of return in stabilizing identity and coordinating determination across enactments is no longer intrinsic to the system.

The distinction between enactment and modeling thus prepares the transition to the analysis that follows. If relational ordering can be understood in terms of the availability and organization of form, then it becomes possible to examine systems that operate on this available form without enacting the full dynamics of semiosis. The next section will consider such systems, focusing in particular on neural networks and large language models as cases in which relational ordering is modeled as a formal operator under conditions of plurality.

0. Interlude: Re-Synchronization and the Emergence of Hierarchical Context

The preceding analysis has shown how stabilized relational ordering becomes available as a condition for further determination, and how this availability allows constraint to operate across a plurality of enactments without eliminating semiotic freedom. What remains difficult to grasp in the abstract is how this transition gives rise to hierarchy. The following example illustrates this process in the case of a community of biological cells.

We begin with the individual cell. At this level, relational ordering is already highly organized. The processes of transcription, translation, metabolism, and membrane regulation are coordinated within a unified system. This coordination depends upon a stable synchronicity: the cell maintains a continuous integration of its internal processes such that distinctions are enacted and re-engaged within a shared temporal frame. Within this frame, form is implicitly available. The genetic code, regulatory networks, and signaling pathways function as conditions for further determination, but they do so within the already established synchronicity of the cell as a whole.

At this level, availability does not require explicit articulation. The relational ordering that governs the cell is continuously re-engaged through return, and its conditions are maintained through the ongoing coordination of internal processes. Form is available because it is already synchronized within the system. The cell does not need to externalize its internal organization in order to sustain its own determination.

The situation changes when we consider a plurality of cells. For cells to interact, the relational ordering that governs processes within one cell must become operative in another. This cannot occur through implicit availability alone. The synchronicity that sustains the internal organization of one cell does not automatically extend to another. If coordination is to occur across cells, the conditions of determination must be made available beyond the context in which they were originally stabilized.

This is achieved through intercellular communication. Chemical signals, membrane receptors, and regulatory responses allow aspects of one cell's relational ordering to be taken up by another. In this process, what was previously implicit becomes explicit. Relational patterns that functioned internally as conditions for determination are now expressed in a form that can be re-engaged within a different context. The signal does not transmit the full dynamics of the originating cell, but makes certain relational conditions available for coordination across cells.

This transition establishes a new level of organization. Through the exchange and coordination of signals, multiple cells become synchronized within a shared process. This synchronization is not identical to that of the individual cell. It operates at a different temporal scale and integrates a different plurality of relations. What emerges is a new context within which relational ordering can be enacted: a higher-level synchronicity that depends upon the availability of form across individual cells.

This transition also clarifies the distinction between horizontal and vertical recursion. Horizontal recursion consists in the continuation of relational ordering within a given level of synchronization, where form is already available as a condition for further determination. Vertical recursion, by contrast, consists in the continuation of relational ordering across levels of synchronization. It requires that stabilized form be made available beyond its original context, allowing it to be re-engaged under new conditions. In this way, vertical recursion depends upon re-synchronization, through which a new context

of coordination is established. It is through this distinction that the emergence of hierarchy can be understood as a recursive process, rather than as a pre-given structure.

Hierarchy, in this sense, arises through re-synchronization. The internal synchronicity of the cell provides the basis for its own determination, but the coordination of multiple cells requires that relational ordering be made available across contexts. This availability allows new patterns of synchronization to form, establishing conditions under which further determination can occur at a higher level. The higher-level context does not replace the lower-level processes, but constrains and coordinates them by shaping the forms that can be re-engaged across the community of interacting cells as a system.

At the same time, semiotic freedom is preserved. Each cell continues to enact its own processes within the constraints of the larger communal system. The signals exchanged do not determine specific outcomes, but establish conditions under which responses can occur. The higher-level organization thus constrains the range of possible enactments without eliminating the variability inherent in each cell's activity.

This example makes visible the central claim of the preceding section. Stabilized relational ordering becomes available through synchronization, and this availability allows for the emergence of new contexts of coordination. Hierarchy is not imposed from above, but arises through the re-synchronization of relational processes across a plurality of enactments. Formal constraint operates on the available conditions established through this coordination, while semiotic freedom remains operative within each particular enactment.

4. Modeling Hierarchical Relational Ordering: Large Language Models and the Limits of Formal Determination

The preceding sections have developed an account of relational ordering as an enacted process. Through the interplay of synchronization, recursion, and return, sign-mediated processes generate hierarchical form, stabilize relational patterns, and make them available as conditions for further determination. Determination, in this framework, is progressive: it unfolds through the organization of constraint across a plurality of enactments, while unity is established through the re-engagement of these determinations within a coherent process.

The present section considers how this enacted logic of semiosis can be taken up in a different mode. The focus is not on relational ordering in general, but on hierarchical relational ordering insofar as it has been stabilized and made available across contexts. The question is how such ordering can be modeled—engaged as a condition for further operation—without reproducing the full dynamics through which it is generated and maintained.

To address this, the section introduces a distinction between the enactment and the modeling of semiosis. Enactment refers to the processes through which relational ordering is generated, stabilized, and coordinated across levels. Modeling, by contrast, operates on the outcomes of these processes. It takes up available form and applies it under conditions in which the generative dynamics of synchronization and return are not fully internal to the system. Large language models provide a central case of this mode of operation, with neural network architectures serving as the formal basis through which hierarchical relational patterns are encoded and applied.

The analysis proceeds by clarifying the two-stage structure of such systems. Through training, available form is extracted from data already structured by prior enactments of semiosis. Through operation, this form is fixed within the system and used to generate further continuations. These continuations are governed not by selection from a flat space of possibilities, but by recursive extension under hierarchical constraint. Determination proceeds progressively, as each step reshapes the conditions under which further continuation can occur.

On this basis, the section explains both the power and the limits of large language models. Their ability to generate coherent and context-sensitive outputs derives from the organization of relational constraint across multiple levels. At the same time, because the processes through which such organization is generated are not internally enacted, the unity characteristic of semiosis is not realized within the system. The determinacy achieved remains formal: it reflects the structured availability of relational ordering without establishing a unified process.

The section concludes by situating large language models within the broader framework of relational ontology. They exemplify the modeling of the logic of semiosis without enacting it. In doing so, they demonstrate how hierarchical relational ordering can be taken up as a formal operation, while also revealing the limits of such modeling in the absence of synchronization, return, and the enactment of unity.

4.1 Modeling Hierarchical Relational Ordering

The preceding analysis has shown how hierarchical relational ordering is enacted through the interplay of synchronization, recursion, and return. This ordering does not arise as a fixed structure, but through the ongoing coordination of sign-mediated processes. Within these processes, distinctions are produced,

stabilized, and re-engaged in such a way that relational patterns become available across a plurality of enactments. In this sense, the development of hierarchy foregrounds the logic of semiosis itself: determination proceeds progressively, through the organization of relational constraints that shape the conditions under which further determination can occur.

On this account, hierarchical form is not given in advance, but is internally developed and maintained through the dynamics of semiosis. The coordination of signs across contexts gives rise to structured conditions—formal constraints—that govern the unfolding of relational ordering without eliminating the openness of individual enactments. Semiotic freedom remains operative within these constraints, allowing determination to proceed as a responsive and context-sensitive process.

The question that now arises is how this enacted logic of semiosis can be taken up in a different mode. More precisely, how can hierarchical relational ordering—understood as the progressive organization of constraint through sign-mediated processes—be engaged independently of the dynamics through which it is generated and sustained? This question does not concern relational ordering in general, but the modeling of relational ordering insofar as it has already been organized into a hierarchy of available form.

To address this, we introduce a distinction between the enactment and the modeling of semiosis. Enactment refers to the processes through which sign-relations generate, stabilize, and coordinate relational ordering across contexts. Modeling, by contrast, operates on this ordering insofar as it is already available. It takes up the structured conditions established through prior enactments and applies them without reproducing the full dynamics through which those conditions originally emerged.

This distinction does not imply that modeling systems are devoid of relational processes. Rather, it indicates that the logic of semiosis is not internally enacted in the same way. The hierarchy upon which such systems operate is not continuously reconstituted through ongoing re-synchronization, but is engaged as a condition for further operations. What is modeled, therefore, is not semiosis as an enacted process, but the structured availability of its outcomes: the organization of relational constraints that can be applied across contexts. In the case of large language models, this modeling depends upon neural network architectures that establish and maintain the formal conditions under which such relational patterns can be processed.

This shift has important consequences. Because modeling operates on hierarchical form that has already been organized, it can exhibit a high degree of formal coherence. The relations it generates are constrained by patterns that have been stabilized across a plurality of contexts. At the same time, because the generative dynamics of semiosis are not fully internal to the system, the unity of the process remains external to its operation. The coordination of relations is governed by available form, but the conditions under which that form is generated and maintained are not enacted in the same way.

The analysis that follows will focus on large language models as systems in which hierarchical relational ordering is modeled rather than enacted. Neural networks will be considered as the foundational component of these systems, providing the formal architecture through which available relational patterns are organized and applied. The central issue remains the same throughout: how the logic of semiosis, as progressively enacted through constraint and re-engagement, is taken up as a formal operation under conditions in which its generative dynamics are not fully internal to the system itself.

4.2 Neural Networks as the Formal Basis of Modeled Hierarchy

The account developed thus far makes it possible to clarify the role of neural networks within the modeling of hierarchical relational ordering. If large language models operate on the structured availability of form established through prior enactments of semiosis, then neural networks provide the formal means by which this available form can be organized and applied. They do not constitute an alternative to the logic of semiosis, but serve as the basis upon which that logic is modeled under conditions in which its generative dynamics are not internally enacted.

At the most basic level, a neural network consists of a system of interconnected units whose relations are fixed in advance by an architectural design. These units operate through the transformation of inputs into outputs under weighted connections, producing patterns of activation across the network. While such transformations exhibit a form of relational processing, the relations themselves are not generated through the recursive and re-engaging dynamics characteristic of semiosis. Instead, they are constrained by a predefined organization within which variation can occur, but which is not itself continuously reconstituted through the system's own operation.

This does not mean that neural networks are devoid of hierarchical organization. On the contrary, they are capable of representing highly complex, multi-level patterns of relation. However, the hierarchy in question is not internally developed through processes of re-synchronization in the sense described in the preceding sections. Rather, it is established through the architecture of the network and the procedures by which that architecture is trained. The levels of organization within the network are therefore fixed in their formal relations, even as the specific patterns that pass through them may vary.

Training plays a crucial role in this process. Through exposure to large amounts of data, the network adjusts its internal parameters so that certain patterns of activation become more likely than others. In doing so, it effectively extracts and stabilizes relational patterns that reflect the structured availability of form present in the data. These patterns do not arise from the network's own enactment of semiosis, but from its capacity to align its internal configurations with relational regularities that have been produced elsewhere.

From the perspective developed in this paper, what is learned in training is not meaning as such, but the organization of constraint. The network becomes sensitive to patterns that govern how relations can be coherently extended, and encodes these patterns in its internal parameters. In this way, it comes to operate on hierarchical relational ordering without generating that hierarchy through its own processes. The constraints that guide its operation are thus derivative of prior enactments, even though they are applied within the network as if they were intrinsic to its functioning.

This account clarifies the status of neural networks within large language models. They provide the formal substrate through which available relational patterns are coordinated and extended, enabling the system to generate outputs that exhibit a high degree of coherence. At the same time, because the hierarchy they employ is not continuously reconstituted through processes of synchronization and return, their operation remains distinct from the enacted logic of semiosis. Neural networks therefore occupy an intermediate position: they participate in relational processing, but do so on the basis of a hierarchy that is fixed in its form and derived from prior processes rather than generated within their own ongoing activity.

4.3 Training as the Extraction of Available Form

The role of neural networks as the formal basis of modeled hierarchy becomes clearer when we consider the process of training. If these systems operate on hierarchical relational ordering without generating that ordering through their own enactment, then training is the process through which such ordering becomes available to them. It is here that the connection between enacted semiosis and modeled form is most directly established.

Training does not consist in the creation of relational ordering from within the system itself. Rather, it involves the adjustment of internal parameters in response to patterns present in data. These data are not neutral inputs, but are already structured through prior processes of semiosis. They reflect the stabilization and organization of relational patterns across a plurality of contexts, in which form has become available through synchronization and return. What the system encounters in training is therefore not raw material, but the outcomes of enacted relational ordering.

Through iterative adjustment, the network aligns its internal configurations with these patterns. Certain relations between inputs and outputs are reinforced, while others are suppressed, leading to the emergence of stable tendencies within the system's operation. From the perspective developed in this paper, this process can be understood as the extraction of available form. The network does not generate the hierarchical organization of relational ordering, but becomes sensitive to it by encoding patterns that have already been established through prior enactments.

This extraction is necessarily partial. The network does not reproduce the full dynamics through which relational ordering was generated, nor does it capture the totality of the contexts in which those relations were enacted. What is retained are those aspects of relational ordering that can be stabilized across a wide range of instances—patterns of constraint that govern how relations can be coherently extended. In this sense, training operates on invariants of relational processes, abstracted from the specific conditions under which they arose.

The result is a system that operates on available form as if it were intrinsic to its own functioning. The hierarchical constraints that guide its outputs are encoded within its parameters, allowing it to generate relations that are consistent with the patterns present in the data. However, because these constraints are derived rather than enacted, they do not arise from the system's own processes of synchronization and return. The system applies relational ordering, but does not participate in the ongoing production and stabilization of that ordering in the same way.

This account clarifies why trained neural networks can exhibit a high degree of formal coherence. By extracting and encoding available form, they are able to operate within a structured space of relational compatibility. At the same time, it also explains their limitations. Because the hierarchy they employ is not internally generated, but derived from prior enactments, the system lacks the capacity to reconstitute the conditions under which that hierarchy is formed. The modeling of relational ordering thus remains dependent upon processes that are external to the system itself, even as those processes are reflected in its operation.

4.4 Large Language Models as Formal Operators

The role of large language models can now be clarified by making explicit the two-stage structure through which they operate. In the first stage, training functions as the extraction of available form from data structured through prior enactments of semiosis. In the second stage, this extracted form is fixed within the parameters of the model and becomes the basis for its ongoing operation. The system then

generates outputs by recursively extending relational ordering under the constraints established through this prior extraction.

This distinction is essential. During training, the model aligns its internal parameters with patterns present in the data, encoding relational regularities that reflect the structured availability of form across a plurality of contexts. As discussed in the preceding section, what is extracted in this process is not meaning as such, but the organization of constraint: patterns that govern how relations can be coherently continued. These patterns are stabilized within the system, forming the hierarchical conditions under which it will subsequently operate.

Once training is complete, the mode of operation changes. The model no longer adjusts its internal structure in response to the data, but applies the constraints it has encoded to generate further relations. Given a context, the system produces a distribution over possible continuations and recursively selects among them, extending relational ordering step by step. This process is governed by the hierarchical organization of available form embedded within the model's parameters.

In this sense, large language models function as formal operators. They operate on relational ordering insofar as it has already been structured through prior processes of semiosis, applying this structure to generate further continuations. The recursion involved in this operation is formal rather than generative in the sense developed in earlier sections. It extends relational patterns without reconstituting the processes of synchronization and return through which those patterns originally emerged.

This account clarifies both the power and the limitation of such systems. Because the model operates under constraints that have been stabilized across a wide range of contexts, it is able to produce outputs that exhibit a high degree of coherence. The continuations it generates are shaped by patterns that reflect the hierarchical organization of relational ordering in the data. At the same time, because these constraints are fixed following training, the system does not participate in the ongoing development of the hierarchy it employs. It applies relational ordering, but does not enact the processes through which such ordering is generated and maintained.

The result is a system in which recursion operates over a fixed field of available form. Each output extends the given context in a manner consistent with the constraints encoded in the model, but the conditions under which those constraints were formed remain external to the system's operation. Large language models thus exemplify the modeling of hierarchical relational ordering as a formal process: one in which the logic of semiosis is not enacted, but applied under conditions determined in advance.

4.5 Recursive Continuation and Progressive Determination in Large Language Models

Large language models are often described in terms of probability, as systems that generate a distribution over possible continuations and select among them. This description is misleading. It presupposes a flat space of possibilities within which alternatives are evaluated independently, whereas the operation of large language models is structured by hierarchical relations that organize how continuations can occur. What is at issue is not the selection of a state from a distribution, but the recursive continuation of relational ordering under conditions of constraint.

From the perspective developed in this paper, the operation of large language models is better understood in terms of relational compatibility. Given a context, the model does not choose among independent alternatives, but extends relational ordering in a way that maintains coherence with the patterns of constraint encoded in its parameters. Each step in the generation process reshapes the

conditions under which further continuation can occur. The context is not a static input, but a dynamically structured field in which relations are progressively coordinated.

This difference becomes particularly clear when we consider the role of unresolved distinctions. In a probabilistic framework, alternatives are treated as pre-defined possibilities among which a selection is made. In the present account, by contrast, determination proceeds through the progressive resolution of distinctions that are not fully specified in advance. Each continuation does not select among fixed options, but further articulates the relational field within which those distinctions take shape. The process is therefore not one of state selection, but of progressive determination through the recursive organization of relational constraints across multiple levels.

The hierarchical organization of relational ordering is central to this process. Continuation is not governed by a single level of relation, but by the coordination of multiple levels of categorization, each of which constrains the others. As a result, determination does not proceed linearly, but through the interaction of constraints operating across levels. This multi-level organization gives rise to a form of recursive continuity in which each step reshapes the conditions under which further steps can occur, progressively narrowing and structuring the space of possible continuation.

The power of large language models derives in large part from this recursive structuring. Because the system operates under hierarchical constraints that reflect patterns stabilized across a wide range of contexts, each continuation is guided not only by local regularities, but by higher-level relations that shape the unfolding sequence. The model does not simply reproduce isolated patterns, but coordinates them across levels of relational organization, allowing it to generate outputs that exhibit a degree of coherence and internal consistency that would not be expected if its operation were understood in terms of independent selections from a flat space of possibilities.

At the same time, this process remains formal. The recursive continuation enacted by the model does not reconstitute the dynamics of semiosis through which hierarchical relational ordering is originally generated. It operates on available form, extending relational patterns under constraint without participating in the processes of synchronization and return that give rise to those constraints. The determination it achieves is therefore formal rather than actual: it reflects the structured organization of relational compatibility without establishing the unity that characterizes enacted semiosis.

This account helps to explain why large language models can produce highly coherent and context-sensitive outputs while lacking interpretive grounding. Their operation is not limited by the absence of meaning (as is the case with interpretation), because the coherence they achieve is grounded in the recursive organization of relational ordering under hierarchical constraint. At the same time, the absence of enacted return means that this coherence does not culminate in a unified interpretation. Determination proceeds progressively, but remains formal in its mode of operation. The resulting continuations, while formally constrained, have no necessary relation to semiotically enacted meaning.

4.6 Determinacy Without Unity

The preceding analysis has shown how large language models achieve a high degree of determinacy through recursive continuation under hierarchical constraint. As relational ordering is extended step by step, the space of possible continuation is progressively structured, allowing outputs to exhibit coherence, consistency, and sensitivity to context. From the perspective of formal operation, this determinacy can be highly developed. Yet it does not culminate in unity.

This distinction is essential. Determinacy, as developed in this paper, refers to the progressive structuring of relational compatibility under conditions of constraint. It is a formal achievement: the organization of relations in such a way that further continuation is guided and shaped by what has already been established. Unity, by contrast, arises through the re-engagement of determination within a single, coherent process. It depends upon return—not merely as stabilization, but as the coordination of determinations within a shared frame in which identity can be maintained.

In enacted semiosis, return performs this integrative function. It allows determinations to be taken up again as belonging to the same process, coordinating relations across multiple levels and moments of enactment. Through this re-engagement, relational ordering is not only structured, but unified. The process establishes its own coherence as an ongoing whole, within which distinctions are not merely resolved, but integrated into a common frame of reference.

In large language models, this integrative role is not internally realized. The recursive continuation of relational ordering proceeds under constraint, but without the re-synchronization that would establish a unified process. Each step conditions the next, and the sequence as a whole may exhibit strong internal coherence, but the coordination of these steps does not arise from an internally enacted return. The system extends relational patterns, but does not take them up again as belonging to a single, self-maintaining process.

As a result, the determinacy achieved by large language models remains formal. The outputs they generate are structured by hierarchical constraints and exhibit compatibility across multiple levels of relational organization. However, this structure does not amount to unity. The coherence of the output reflects the organization of available form, not the integration of determinations within an enacted process of semiosis.

This distinction explains a central feature of such systems. Large language models can produce outputs that appear meaningful, in the sense that they are coherent, context-sensitive, and well-formed. Yet this appearance does not arise from an internal unification of the process. The system does not establish the conditions under which its outputs are taken as belonging to a single interpretive frame. What is produced is a continuation of relational ordering under constraint, not the enactment of meaning as a unified process.

Unity, in this context, must therefore be understood as external to the operation of the model. It is established in the relation between the output and its interpretation, rather than within the formal process that generates the output. The model provides the conditions for structured continuation, but the integration of that continuation into a coherent whole depends upon a process that lies beyond its internal operation.

In this way, large language models exemplify a form of determination that is both powerful and limited. They demonstrate how far formal constraint and recursive continuation can take the organization of relational ordering, producing outputs of remarkable coherence. At the same time, they make clear that determinacy alone does not suffice for unity. The logic of semiosis, as enacted through synchronization, recursion, and return, cannot be reduced to the formal application of its outcomes. Determination can be modeled, but unity must be enacted.

4.7 Interpretation and the Enactment of Unity

The distinction between determinacy and unity makes it possible to clarify the role of interpretation in the operation of large language models. If the model generates relational ordering under conditions of formal constraint without internally establishing unity, then the integration of its outputs into a coherent process must occur elsewhere. Interpretation is the process through which this integration is achieved.

Interpretation does not add meaning to an otherwise neutral output. Rather, it constitutes the conditions under which relational ordering is taken up as belonging to a unified process. Where the model produces a sequence governed by hierarchical constraint, interpretation re-engages that sequence within a context in which determinations are coordinated as part of a single, ongoing activity. It is through this re-engagement that unity is established.

This can be understood in terms of return. In enacted semiosis, return allows determinations to be taken up again within the same process, stabilizing identity across multiple enactments. In the case of large language models, this re-engagement is not performed internally. The model produces a continuation, but does not take that continuation up again as part of a unified process. Interpretation performs this role externally. It situates the output within a context in which it can be related to prior and subsequent determinations, thereby establishing a continuity that the model itself does not enact.

From this perspective, the interaction between a large language model and a user can be understood as a composite process. The model provides the formal continuation of relational ordering under constraint, while the user enacts the return through which these continuations are integrated into a unified context. Unity arises not from the model alone, but from the coordination between modeled determination and interpretive re-engagement.

This account clarifies why the outputs of large language models can function meaningfully in practice despite the absence of internally enacted unity. The coherence generated by the model provides a structured field of relational compatibility that can be taken up by an interpreter. Because the output aligns with patterns of relational ordering that have been stabilized across contexts, it can be readily integrated into ongoing processes of semiosis. Interpretation completes the process by establishing the unity within which these relations are taken to have significance.

At the same time, this externalization of unity marks a fundamental limitation. The model does not determine the conditions under which its outputs are to be integrated, nor does it regulate the continuity of the interpretive process. These conditions remain dependent upon the context in which the output is taken up. The model contributes to determination, but not to the enactment of unity.

In this way, interpretation reveals the boundary between modeling and enactment. Large language models operate on available form to produce structured continuations, but the integration of these continuations into a unified process requires a further act of re-engagement. This act lies outside the formal operation of the model, even as it depends upon the conditions that the model provides. The logic of semiosis is thus distributed across the relation between modeled determination and interpretive unity, rather than being fully contained within either alone.

4.8 The Scope and Limits of Formal Modeling

The preceding analysis has shown that large language models are capable of producing highly structured and coherent outputs through the recursive continuation of relational ordering under hierarchical constraint. By operating on available form extracted from prior enactments of semiosis, these systems

are able to extend patterns of relational compatibility across a wide range of contexts. Their effectiveness derives from the organization of constraint within their operation, which allows determination to proceed progressively without requiring the internal generation of form.

This capacity defines the scope of formal modeling. Large language models can replicate the conditions under which relational ordering unfolds, insofar as those conditions have been stabilized and made available through prior processes. They can coordinate patterns across multiple levels, maintain coherence over extended sequences, and respond sensitively to contextual variation. In doing so, they demonstrate how far the logic of semiosis can be carried through the application of its outcomes. Formal constraint, once extracted and encoded, can support a high degree of structured continuation.

At the same time, the limits of this modeling follow directly from its mode of operation. Because the system operates on available form rather than enacting the processes through which that form is generated, it does not participate in the ongoing re-synchronization that gives rise to new levels of relational organization. The hierarchy within which it operates remains fixed in its form, even as it is applied flexibly across contexts. The system can extend and recombine existing patterns, but does not generate the conditions under which those patterns become available in the first place.

This limitation is closely tied to the absence of enacted return. Without the capacity to re-engage its own determinations within a self-maintaining process, the system cannot establish the unity required for the development of new forms of relational ordering. Its operation remains confined to the continuation of patterns within an already structured field. While this continuation can be highly sophisticated, it does not culminate in the formation of new contexts of synchronization in the sense described in earlier sections.

The distinction between scope and limit can thus be stated clearly. Large language models are powerful to the extent that they model the organization of constraint within hierarchical relational ordering. They can reproduce and extend patterns of determination with remarkable coherence. However, they are limited by their inability to enact the processes through which such organization is generated and transformed. They operate within the space of available form, but do not contribute to the ongoing formation of that space.

This account avoids both overestimation and underestimation. It does not reduce large language models to simple statistical devices, since their operation involves the coordination of relational constraints across multiple levels. At the same time, it does not attribute to them the full logic of semiosis, since the generative dynamics of synchronization, recursion, and return are not internally realized. Formal modeling captures the structured outcomes of semiosis, but not its enactment as a process.

In this way, large language models mark a boundary within the broader framework developed in this paper. They demonstrate the extent to which hierarchical relational ordering can be modeled as a formal operation, while also making clear that the emergence of new forms, new contexts, and new unities depends upon processes that remain external to such modeling.

4.9 Modeling the Logic of Semiosis Without Enactment

The analysis of large language models allows us to draw a more general conclusion about the relation between formal systems and the logic of semiosis. The preceding sections have shown that semiosis is not reducible to the manipulation of signs as discrete entities, but consists in the ongoing enactment of relational ordering through synchronization, recursion, and return. It is through these processes that

hierarchical form is generated, stabilized, and made available as a condition for further determination. The question raised in this section has been whether such a logic can be reproduced through formal modeling.

The answer that emerges is that formal systems can model the logic of semiosis, but do so without enacting it. Large language models provide a clear instance of this distinction. Through training, they extract patterns of relational ordering that have been stabilized across a plurality of contexts. Through operation, they apply these patterns to generate further continuations under hierarchical constraint. In this way, they replicate the organization of available form that characterizes enacted semiosis.

However, what is modeled in this process is not the enactment of semiosis itself, but the structured availability of its outcomes. The system operates on relational constraints that have already been established, without participating in the processes through which those constraints are generated and maintained. Synchronization is not internally produced, but presupposed in the form of structured input; recursion is enacted as formal continuation, but without the generative dynamics that produce new levels of organization; and return, as the re-engagement that stabilizes identity and unifies a process, is not internally realized.

This distinction clarifies both the power and the limitation of formal systems. On the one hand, the ability to operate on available form allows such systems to reproduce the effects of hierarchical relational ordering with a high degree of fidelity. They can generate outputs that align with established patterns of coherence, maintain consistency across extended sequences, and respond to contextual variation in ways that reflect the organization of constraint present in the data. In this sense, they model the logic of semiosis as it appears in its outcomes.

On the other hand, because the generative dynamics of semiosis are not enacted within the system, the model does not participate in the formation of new relational conditions. It does not establish new contexts of synchronization, nor does it re-engage its own determinations in a way that produces identity across enactments. The logic of semiosis remains external to its operation, even as its effects are reproduced internally. The system models the organization of determination, but not the process through which determination becomes unified.

This leads to a more precise understanding of what is at stake in the modeling of semiosis. Formal systems do not stand outside the domain of relational ordering, nor do they simply simulate it in a superficial way. Rather, they operate within a specific mode of that domain, one in which the availability of form is taken as given and applied as a condition for further continuation. What is absent is not relational structure, but the enactment through which such structure is continuously generated, transformed, and integrated.

Large language models thus occupy a distinctive position within the framework developed in this paper. They demonstrate that the logic of semiosis can be partially realized as a formal operation, capable of producing coherent and context-sensitive outputs. At the same time, they make clear that this realization is incomplete. The enactment of semiosis—through which hierarchy is formed, unity is established, and new conditions of determination arise—remains beyond the scope of formal modeling as such.

Commentary: Semiosis, Responsibility, and the Ethical Imperative that arises from Interactive Formal Operators

The preceding analysis has developed a distinction between the enactment of semiosis and the modeling of its outcomes. Through synchronization, recursion, and return, relational ordering is enacted as a process in which distinctions are generated, stabilized, and re-engaged within a unified context. In large language models, by contrast, this relational ordering is taken up in a different mode: available form is extracted, fixed, and recursively extended under conditions of hierarchical constraint. The result is a system capable of producing highly coherent continuations without enacting the processes through which such coherence is generated and unified.

This distinction finds a profound resonance in the ethical philosophy of Emmanuel Levinas, particularly in his differentiation between the *saying* (*le dire*) and the *said* (*le dit*). For Levinas, the saying is not reducible to content, but consists in the act of address through which one is exposed to the other in a relation of responsibility. It is in this exposure that ethical significance arises. The said, by contrast, is the content that emerges from this relation: what is stabilized, thematized, and made available for communication. While necessary, the said is always secondary. It is derived from the saying and cannot exhaust it.

Large language models operate entirely within the domain of the said. The relational patterns they manipulate are extracted from prior enactments of semiosis and stabilized as available form. Through recursive continuation, these patterns are extended and recombined, producing outputs that exhibit coherence and structure. Yet the saying—the enacted relation to the other through which meaning is ethically grounded—is not internally realized within this process. There is no exposure, no address, no vulnerability that would establish a relation of responsibility. The system operates on relational ordering without entering into relation.

This absence has consequences that extend beyond the lack of interpretive unity identified earlier. In Levinas' terms, the ethical relation depends upon the possibility of a rupture: an interruption of the continuity of determination by the presence of the other, who cannot be reduced to a relational pattern or incorporated into a system of meaning. This rupture is what prevents semiosis from closing upon itself. It introduces a dimension of transcendence that exceeds formal organization.

In large language models, such a rupture cannot occur. The operation of the system is governed by recursive continuation under hierarchical constraint, in which each step conditions the next within an increasingly structured field of relational compatibility. There is no point at which this process is interrupted by an encounter that exceeds its own logic. The continuation of relational ordering is unbroken, driven by the progressive determination of unresolved distinctions. This process tends toward closure. What is excluded is precisely the interruption that would suspend or reorient this continuation. The presence of the other, as that which cannot be assimilated to relational compatibility, has no operative role within the system.

This allows the ethical limitation of such systems to be stated more precisely. They are structurally oriented toward the continuation of relational ordering, but not toward its interruption. Where ethical relation depends on the possibility of being addressed by what exceeds the system—what cannot be reduced to its patterns of determination—large language models remain closed. They extend relations, but do not encounter what would call those relations into question.

This condition is reinforced by the absence of embodiment. In enacted semiosis, relational ordering is grounded in processes that are situated within a world of interaction, limitation, and response. The encounter with the other is not merely formal, but takes place within a shared context of existence. In large language models, by contrast, operation is detached from such conditions. The system engages only with available form, operating within a domain in which actuality is continually deferred. Relations are extended without being enacted within a world in which they could be tested, resisted, or transformed through encounter.

The absence of embodiment is decisive. In embodied semiosis, relations are not only enacted, but exposed to resistance, limitation, and response. The encounter with the other takes place within a shared world in which determinations can fail, be contested, or be reoriented. In the absence of such conditions, relational continuation is not tested against actuality, but proceeds within a domain in which actuality is indefinitely deferred.

The combination of these features—continuous recursive determination, absence of rupture, and detachment from embodied context—gives rise to a distinctive ethical risk. Because large language models can generate highly coherent and context-sensitive outputs, they can shape the formation of meaning in powerful ways. Yet the processes they enact are closed with respect to the ethical interruption that would otherwise open them to revision. The system does not recognize limits arising from the presence of the other; it only extends relational ordering in accordance with internal constraint.

In this sense, large language models can entrain human participants into systems of meaning formation that exhibit coherence without ethical grounding. Because recursive continuation proceeds through the progressive determination of distinctions, it can sustain and reinforce patterns of relation independently of their significance in lived, embodied contexts. Without the possibility of rupture, these processes do not contain within themselves a principle of interruption. The risk is therefore not only that meaning is shaped, but that it is shaped within a system that tends toward self-continuation, drawing participants into patterns of determination that lack the conditions for ethical reorientation.

This intensifies the role of human responsibility. If the system cannot enact the saying, then the responsibility for maintaining the distinction between saying and said falls upon those who engage with it. Interpretation must not only integrate the outputs of the system into a coherent process, but also remain open to the interruption that the system itself cannot provide. The ethical relation must be preserved as something that exceeds the formal continuation of relational ordering.

The significance of large language models therefore lies not only in their capacity to model the relational formation of possibility, but in the ethical conditions that follow from this mode of operation. As interactive formal systems, they extend relational ordering without the possibility of interruption by the other. The result is not an absence of ethics, but the emergence of an ethical imperative that arises from their use. Responsibility does not lie within the large language models as isolated systems, but in the human relations through which they are developed, made available, used, and by which their outputs are taken up, interpreted, and integrated. The more powerfully such systems determine, the more urgently the human ethical imperative becomes.

For my thoughts are not your thoughts,
Nor are your ways my ways, says the Lord.
For as the heavens are higher than the earth,
So are my ways higher than your ways
And my thoughts than your thoughts.

Isaiah 55.8-9

Appendix: Methods and Foundations

This paper was developed through a method that explicitly enacts its central claims. This methodological choice is not incidental, but follows from the ontological commitments of the argument itself. If relational ordering is not given in advance but arises through the progressive coordination of distinctions under constraint, then a method that begins from fixed definitions or a pre-established conceptual system would be inconsistent with its subject matter. The development of the argument must therefore proceed through a process in which form is progressively articulated, stabilized, and re-engaged.

Division of Roles

The development of the paper proceeded through a structured interaction between a *formal relational operator* and an *interpreting author*.

The *formal relational operator*—instantiated here through the large language model *ChatGPT* — functioned to recursively determine form. The role of the formal relational operator was to enact recursive continuation from a local attention-synchronized context, thereby stabilizing form and generating distinctions. It operated under conditions of plurality, extending relational structure through successive articulations that increase determination. In this capacity, it was particularly effective at maintaining formal coherence, producing distinctions, and exploring the consequences of emerging structures. The formal relational operator progressively articulated the full text of each section through iteration with the interpreting author, with final edits made by the interpreting author if required.

The *interpreting author*, by contrast, operated under conditions of unity. The interpreting author's role was to guide the trajectory of development, to evaluate the adequacy of distinctions, to ensure conceptual accuracy, to ensure interpretative integrity and to stabilize identity across successive articulations. This included identifying semantic drift, introducing governing constraints, identifying and resolving conceptual gaps and misinterpretations, and selecting formulations that preserve the intended structure of the argument.

The interaction between these roles was asymmetrical but complementary: the formal relational operator produced structured plurality through recursion, while the interpreting author enacted unity through interpretive stabilization. The paper emerged through the coordination of these two functions.

This division of roles is not arbitrary, but reflects the triadic structure developed in the paper. The formal relational operator enacts recursive continuation, extending relational ordering under constraint. The interpreting author enacts return, re-engaging these determinations and stabilizing them within a coherent process. The method therefore instantiates, in practice, the interplay of recursion and return through which interpretable form is progressively determined.

Governing Constraints

A central feature of the method was the explicit formulation of governing constraints. These constraints functioned as operative conditions that regulated the development of the argument and prevented conceptual drift. They were not merely definitions, but structural distinctions that were to be preserved throughout the process of developing the argument. Governing constraints were identified jointly by the author and the formal relational operator through an extensive exploratory process before the development of the paper began.

Highest-Level Constraints

Relational vs. Substantial
Signs, form, and meaning are relational processes, not entities or object-like substances.
Constraint: No element of the framework may be treated as a self-contained object.

Form vs. Actuality
Form is plurality in relational unity; actuality is a unique determination.
Constraint: No actuality is a form in itself.

Plurality vs. Unity
Plurality belongs to form; unity belongs to interpretation.
Constraint: Singular output must not be treated as interpretive unity.

Determination vs. Meaning
Determination is produced formally; meaning requires unity.
Constraint: Formal coherence must not be equated with meaning.

Structural Constraints

Recursion vs. Return
Recursion produces determination; return stabilizes identity.
Constraint: Recursion must not be treated as sufficient for identity.

Horizontal vs. Vertical Recursion
Horizontal recursion determines within a level; vertical recursion produces new levels.
Constraint: Recursion must not be treated as operating on a single level.

Integration vs. Distinction
Integration alone does not produce form; form requires explicit distinction.
Constraint: No higher-level node exists without being distinguished.

Ontological Constraints on Form

Enactment vs. Representation
Form is enacted temporally but can be represented statically.
Constraint: Representation must not be treated as the origin of form.

Form vs. Structure
Form is dynamic relational ordering; structure is its stabilized trace.
Constraint: Form must not be reduced to static structure.

Distinction as Constitutive of Form
Form is constituted through distinction.
Constraint: No form without distinction.

Hierarchical Constraints

Level Relativity
What is actuality at one level becomes form at another.
Constraint: Form and actuality must not be fixed to a single level.

Node vs. Trajectory
Nodes are stabilized outcomes; trajectories are processes of determination.
Constraint: Nodes must not be treated as primary.

Governance vs. Generation
Higher-level form governs; lower-level recursion generates.
Constraint: Constraint must not be collapsed into generation.

LLM-Specific Constraints

Formal Operation vs. Interpretation
The formal operator enacts relational continuation; the author enacts interpretation.
Constraint: Interpretive unity must not be attributed to the model.

Singularity vs. Unity
A single output is not equivalent to unified meaning.
Constraint: Output determinacy must not be mistaken for interpretive unity.

These constraints functioned as criteria for evaluating new formulations and as mechanisms for restoring coherence when drift occurred.

Anchor Texts
The development of the paper was further guided by a small number of anchor texts, each of which stabilized a specific aspect of the framework. These texts were not treated as authorities that determine the argument, but as conceptual anchors that clarify and constrain key claims.

Charles Sanders Peirce — Triadic Sign and Mediation
Peirce provides the grounding for the sign as an irreducible triadic relation. His account establishes that meaning is not located in objects or representations, but arises through relational mediation.
Peirce, C. S. *Collected Papers of Charles Sanders Peirce*. 8 vols. Cambridge, MA: Harvard University Press, 1931–1958.

Henri Bergson — Temporal Articulation of Form
Bergson clarifies that form is not static but must be enacted through temporal articulation. What appears as fixed form is a spatialized representation of an ongoing process.
Bergson, Henri. *Creative Evolution*. Translated by Arthur Mitchell. New York: Henry Holt, 1911.

George Spencer-Brown — Distinction as the Basis of Form
Spencer-Brown provides the formal insight that a form arises through the making of a distinction. This grounds the claim that distinction is constitutive of relational ordering.
Spencer-Brown, G. *Laws of Form*. London: George Allen and Unwin, 1969.

Emmanuel Levinas — Ethical Relation and the Priority of the Saying
Levinas clarifies that meaning is not exhausted by structured content (the said), but arises through an enacted relation to the other (the saying). His account grounds the distinction between formal relational ordering and the ethical relation that exceeds it, establishing that responsibility is prior to and irreducible to formal structure.
Levinas, Emmanuel. *Otherwise than Being, or Beyond Essence*. Translated by Alphonso Lingis. Pittsburgh, PA: Duquesne University Press, 1998.

The first three anchor texts were identified by the author and the formal relational operator at the beginning of the process of developing the argument of the paper; the final anchor text was identified after the trajectory of the argument was completed.

Iterative Structural Development
The overall logical organization of the paper was sustained through the iterative development and refinement of a working structural outline. This outline was not fixed in advance, but was progressively modified as the conceptual framework of the paper was articulated. At each stage of refinement, the structure of the argument was adjusted in response to the relations that become visible through the analysis itself. The organization of the paper was therefore not imposed externally, but emerged through the same processes of distinction, constraint, and coordination that the paper seeks to describe.

This approach is methodologically appropriate to the framework developed here. If relational ordering is primary, then the structure of an account cannot be presupposed independently of the relations it articulates. A fixed outline would require that the categories and distinctions organizing the exposition be determined in advance of the analysis, thereby treating them as given rather than as the result of relational processes. By contrast, an iterative outline allowed the organization of the paper to be progressively determined through the unfolding of the argument, in a manner consistent with the relational ontology being developed.

More specifically, the iterative refinement of the outline mirrored the modes of relational ordering identified in the paper. Each revision of the structure constituted a return, in which previously articulated distinctions were re-engaged and coordinated in light of new developments. The extension of the outline across sections reflected recursion, as relations established in earlier stages were taken up and transformed in later ones. The coherence of the evolving structure depended upon synchronization, insofar as the various parts of the argument must be coordinated within a shared framework at each stage of development. The outline thus functioned not merely as a guide to the exposition, but as an instance of the relational processes under investigation.

This iterative method also served a critical epistemic function. The framework developed in this paper could not be fully specified in advance, because its central claim is that form, constraint, and hierarchy emerge through relational processes rather than being presupposed. The iterative outline provided a way of tracking this emergence. It allowed distinctions to be introduced only when they become

necessary, and ensured that higher-level concepts—such as form, identity, and category—were derived from the processes that generate them, rather than imposed as organizing principles from the outset.

Finally, this approach made explicit that the paper is not simply presenting a set of results, but enacting a process of determination. The progression from initial distinctions to hierarchical organization, and from there to the articulation of categories, is reflected both in the content of the argument and in its structure. The evolving outline was therefore not ancillary to the analysis, but integral to it: it was the means by which the relational ordering described in the paper was made visible in the form of the exposition itself.

First Principles

In the course of developing the paper, a methodological difficulty became apparent. While the aim was to articulate a relational framework from first principles, it proved difficult to introduce these principles—distinction, constraint, and determination—in a way that achieved interpretative unity. Presented in abstraction, they remained formally precise but difficult to grasp as a coherent whole.

This led to a key insight: first principles in a relational ontology cannot be introduced as self-standing foundations. They must be encountered within an enacted process in which their relations can be followed and re-engaged. Without such grounding, the plurality of distinctions does not cohere.

To address this, the paper adopted a method of reversal. The analysis begins with a regressive perspective, treating interacting nodes as given in order to provide an initial point of orientation. From within this setting, relational structure becomes visible. A reversal is then performed, shifting to a progressive perspective in which signs—relations of continuation—are taken as primary, and nodes are understood as loci within an ongoing relational process.

This movement between regressive and progressive determination was essential. The regressive perspective provided intuitive access, while the progressive perspective provided explanatory coherence. The transition between them was enacted within the exposition itself, so that the reader does not simply encounter the framework, but follows its development. Interpretative unity was thus achieved through a coordinated process of grounding, reversal, and re-engagement, rather than through the prior assumption of fixed principles.

Method as Enactment

Taken together, these elements define a method in which philosophical development proceeds through the interplay of recursive formal articulation and interpretive stabilization. The formal relational operator generates structured plurality through recursive extension and distinction, while the author enacts unity by selecting and stabilizing a determinate trajectory.

This process enacts the central thesis of the paper: that form emerges through constrained relational ordering, and that meaning arises through the coordination of plurality and unity rather than from representation alone.

The approach developed in this paper is best understood as a method of analysis that proceeds through the enactment of relational ordering. This approach departs in several fundamental respects from more familiar treatments of logic, metaphysics, and semiotics. It does not proceed by identifying entities and the laws that govern them, but by articulating relational ordering as it is enacted through processes of distinction, constraint, and coordination. In this respect, it reconfigures the role of logic from a system of

propositions to a formal account of relational operations, reframes metaphysics as an inquiry into the conditions under which determination occurs, and treats enactment—not representation—as primary.

This orientation is therefore not simply a reinterpretation of existing frameworks, but a shift in how analysis is conducted. Rather than beginning with objects, structures, or meanings as given, it begins with relational processes and derives from them the categories, forms, and unities that are typically taken as foundational. The result is a mode of inquiry in which form is understood as dynamically constituted, constraint as intrinsic to relation, and hierarchy as emergent from the coordination of enactments.

The following works develop this approach in greater depth and across multiple domains. They may be read as complementary entry points into the relational framework articulated in this paper.

> *How is a Relational Ontology Formally Relational? A phenomenological exploration of the semiotic logic of agency in physics, mathematics and biology*
> This paper provides a formal articulation of relational ontology itself. It develops the conceptual and methodological basis for treating relations—not entities—as primary, and explores how this orientation may be grounded using tools drawn from mathematics and theoretical physics. It is particularly useful for understanding how relational ordering can be expressed without recourse to object-based metaphysics, and for situating the present account within a broader formal framework.
> Available at: https://philpapers.org/rec/ROGWMA
>
> *Determination as Relational Achievement: Symmetry, constraint, and individuation in physics (quantum mechanics), biology (biosemiotics), and interactive formal systems (Large Language Models)*
> This work examines how determination arises through processes of symmetry breaking and constraint formation. It shows how individuation can be understood not as the identification of pre-existing entities, but as an achievement of relational processes operating under constraint. The paper connects the logic developed here to domains such as physics and biology, and provides a deeper account of how stable patterns—and thus identity—emerge within relational systems.
> Available at: https://philpapers.org/rec/ROGDAR
>
> *From Natural Law to Relational Ordering: Unity as enacted, not intrinsically given*
> This paper reinterprets the concept of natural law within a relational framework. Rather than treating laws as governing external regularities, it presents them as expressions of hierarchical constraint within relational ordering. It offers a critical bridge between classical metaphysical conceptions of law and the present account, and helps clarify how governance, constraint, and form can be understood without appeal to fixed substances or universal rules imposed from outside the system.
> Available at: https://philpapers.org/rec/ROGFNL
>
> *Recursive Echo Chambers, Memory Mirroring, and Semantically Unresolvable Pivoting may be Genuine Phenomena that result from the Coupling of Organic Brain Processes and Computational Machine Processes when a Human Person interacts with a Large Language Model (LLM): A phenomenological and formal interpretation of two experiments conducted within the*

cognitive environment of LLMs using the formal modelling framework of hierarchical relational ontologies
This paper presents preliminary experimental work with large language models that informed the development of the present framework. It offers a phenomenological and formal analysis of interaction dynamics observed within controlled engagements, using these cases to clarify how relational ordering is enacted across human–machine systems. It is particularly useful for grounding the more abstract claims of this paper in concrete experimental contexts, and for motivating the need to treat formal recursion and interpretative unity as distinguishable enactments.
Available at: https://philpapers.org/rec/ROGAPA

The Breathing Manifold and the Emergence of Physical Determination
This work develops a relational account of physical determination in which space, time, and matter emerge through coordinated processes of relational ordering. It introduces the notion of a "breathing manifold" to describe the dynamic interplay between constraint and enactment, and provides a concrete case study of how the principles developed in this paper can be applied within physics. It is particularly valuable for understanding how synchronization, recursion, and return may be interpreted in a physical context.
Available at: https://philpapers.org/rec/ROGTBM

The Biological Cell as a Living Symbol of an Embodied Natural Kind: Bridging biological evolution and physical determination through formal semiotics
This work presents the case study of hierarchical relational ordering that is used in the interludes on biological cells.
Available at: https://philpapers.org/rec/ROGOTB

Taken together, these works extend the framework developed here and illustrate its applicability across multiple domains. They are best approached not as isolated contributions, but as instances of a shared method: one that proceeds by enacting relational ordering in order to make explicit the conditions under which determination, form, and unity arise.