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# Context Changes Everything

## How Constraints Create Coherence

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## Concluding Remarks

So where has this trail led us? The clearing we have opened—and it is only a clearing, not the final destination—is one where interdependencies woven together through multiple constrained interactions turn out to be as fundamental as the allegedly standalone things and indivisible particles that for millennia served as the ontic basis of Western philosophy and modern science. To fully understand the emergence of those interdependencies, we looked to the notion of interlocking constraints to expand our ideas of cause and effect. Interlocking constraints reinstated mereological interactions and relations into our conceptual framework. Doing so also restored the possibility of true coherence and top-down causation, from minds to bodies, from ecosystems to individual species.

The new world revealed through the lens of complexity is congruent with contemporary science. The one prerequisite: conditions must be open and away from thermal equilibrium. Context-independent constraints take conditions far from homogeneity and equilibrium and establish background inhomogeneities. Doing so satisfies this first requirement. Next, context-dependent constraints take conditions away from independence by making previously separate entities conditional upon one another. Working together in open conditions far from equilibrium, context-independent and context-sensitive constraints bring about mutually dependent interactions and relations. The processes now covary because, acting as enabling conditions and constitutive/governing regimes, constraints have woven individual processes and particles into integral wholes. The book calls them interactional types. Parts and wholes, tokens and types, can finally be understood as two aspects of a shared and interdependent dynamic.

A new coherence.

Coherence is not other than individual particles and processes that comprise it; types are not other than the tokens that realize it. Components do not fuse into blocklike things or blend together in an amorphous

solvent; but neither are interdependencies unstructured tangled banks. Coherent dynamics that are coordinated across multiple scales and dimensions are not dominance hierarchies; they are distributed heterarchies and holarchies. They manifest as differentiated and heterogenous configurations of matter, energy and information held together at the same scale as well as across scales by principles of mutual constraint satisfaction. Significantly, at each scale the interactants retain their integrity even as they contribute to the generation of an emergent whole. Each aspect of a differentiated coherent dynamic embodies and enacts a distinct set of constrained interdependencies with its own logic of emergent properties and powers.

Coherent parts-to-whole and whole-to-parts relations induced by constraints persist in the face of change. Their patterns are metastable, realized as vectors of complex attractors; they define ecosystems, cultures, mindsets, values, and institutions. They are enacted in social practices and activities and are embodied in technologies and traditions. They span the planet's geology, its atmosphere, its biosphere, and its human worlds.

As understood here, then, coherence generally is grounded in interdependent relations conditioned by the past and the spatiotemporal context in which it is embedded—which interdependence, paradoxically, constrained interactions among its constituents themselves induced. By continuously weaving together streams of energy, mass, and information into more comprehensive spatiotemporal dynamics, contextually constrained relations remember; because they are path dependent, they remember. They also specify, modulate, and regulate actual tokens. Records, registers, and memories become incorporated into yet more expansive interdependencies that hold together in time as well as space. As complexity increases each turn of the spiral serves as a foundation, building block, memory, and precursor of the next production of wondrous new properties and powers.

Darwin's survival of the fittest is as much a process of symbiosis making as it is a zero-sum game.

Newly constituted coordination dynamics are effective; they are neither epiphenomenal nor puppets of their constraints. Among the most important capabilities of coherence-making by constraint is top-down influence, from extended coherent invariances down to individual behavior. Once those coherent invariances involve the complex social organizations of human beings, principles, laws, rituals, myths, and traditions have effects just as forceful actions do, both at the individual and the systemic level—just not as forces. So do their emergent properties: thoughts, beliefs,

intentions, values, and feelings. All exercise causality top down, from regimes of constraint that define emergent properties to their manifestation in actions, regulated as cascades of negative feedback and analog decision-making and control. In consequence, the resulting behaviors and actions satisfy the truth conditions set by the emergent properties of those constraint regimes, including those pertaining to cognition and values.

Such real and meaningful top-down causality is possible at all only because ongoing context and path dependence generates flexible, multiply realizable types that span diverse tokens. Emergent properties of contextually generated interdependencies are not transitive across scales or levels of organization; they do not commute. Interactional types as presented in this book are regimes of constraint that must be defined indexically; some must be defined intensionally. The emergent perspective from inside a contextually generated constraint regime is different from the view from outside. Revealed by the filter of constraint, real and effective order parameters can embody the emergent properties of perspective, point of view, and subjectivity. New codes and metrics (including valence, affect, and social and moral values) arise alongside new coherent patterns. Genetics, affect, symbolic language, and ethical norms are codes and metrics that transduce external information into the new interdependencies on the inside. Practices and activities that realize that newly encoded information embody the emergent properties of those interdependencies.

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From their earliest formation, mutually constrained and constraining worlds thus spiral through innumerable iterations of a common theme-and-variation motif. Constrained interactions generate increasingly complex forms. Radically new properties and powers emerge as new interdependencies form. Those emergent properties and powers were not merely waiting to be revealed; evolution is not the unfurling of pre-established potentialities. Each new coherence is a genuine creation, the product of path-dependent multiple constraint satisfaction under open nonequilibrium conditions. Coherence making thus brings about major transformations to emergent dynamics. Constraints make creativity possible; emergent coherent dynamics are the creative outcome of mutually constraining and constrained interactions. The price of such creativity and uniqueness is indetermination and uncertainty. I submit it is a price well worth paying.

Earlier chapters concluded that validated interdependencies persist and evolve because of their contribution to metastability. Epistemically and politically, keeping the conversation going (Rorty1982) is a validated

enabling constraint that contributes to metastability. Both abiotic metastability and keeping the conversation going presuppose open conditions such that continuous exchanges of matter, energy, and information with context are facilitated and preserved by enabling and constitutive constraints. In particular, validated coherence presupposes the presence of those context-dependent constraints that enable the emergence of novel and flexible interdependencies while at the same time stabilizing and preserving metastability.

Only constraint regimes that are self-determining and self-repairing are fluid, and can continuously update contextual information, promote adaptation and evolution, and remain metastable. These considerations imply that governing constraints of metastable dynamics must be distributed, multiply realizable, flexible, and resilient. They must actively encourage and preserve the diversity and multiple realizability of their components. Individuals must not be dissolved into a homogeneous solution; but they lose some of their complex and novel properties if they ignore the context from which they were emerged. They especially lose their integrity if they are unresponsive to the context in which they are currently embedded.

Only metastable constraint regimes yield validated coherence. This is as true for human beings and their communities as it is for Bénard cells and BZ reactions.

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What can we conclude from all this? Tearing down happens naturally. Creating coherence is an energetically costly process: it takes a burst of entropy for context-dependent constraints to irreversibly produce emergent coordination dynamics. Innumerable identical tokens of the one type is a bogus form of diversity. It tends towards stasis and devolution. Uniformity in social contexts does not keep the conversation going. It takes ongoing background, enabling, and governing constraints to generate and maintain multiply realizable metastable interdependencies in nonequilibrium. Such constraints can enable and facilitate evolution and progress. This recursive “form of causality [previously] unknown to us”<sup>1</sup> informs creativity and individuality, from atoms to humans and their organizations, from dust devils to international human organizations; their coherence emerges from the interdependencies the mereological constraints themselves helped cocreate.

Neither puppets nor absolute sovereigns, human beings and the material and social forms of life they induce are true co-creators of their natural and social worlds. We serve as stewards of the metastability, coherence,

and evolvability of both of these worlds. Matter matters. History matters. Social and economic policy matters. Most critically, however, because top-down causality as constraint makes room for meaning and value-informed activities, our choices and actions matter tremendously. In acting, we reveal the variables and the values that really matter to us, individually and to the culture in which we are embedded. We must pay attention to what we pay attention to; to which options we facilitate and promote and which we impede and discard. We must pay particular attention to what we do.

The influence of constraints has been dismissed because they do not bring about change energetically. Because they can be tacit and entrenched, their Escher-like characteristics also make them difficult to track. As background constants that go without saying, they have also been taken for granted. Foregrounding these enabling and governing conditions, so different from but as effective as forceful impacts, has been a central goal of this work.

Facilitating the emergence and persistence of validated coherence, of adaptable and evolvable interdependencies that can continue to form and persist in nature, among human beings and between nature and humankind, is among our most compelling responsibilities. Facilitating the emergence and preservation of a thoroughgoing resilience that affords to both the natural and the human worlds the conditions not only to persist but especially to evolve and thrive is the most pressing moral imperative facing humankind today.



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