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The Effectiveness of Mathematical Formalisms

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In this short article I would like to address the question:

> How is that mathematical formalisms permit us to compute relations in the domain of what we call natural phenomena?

The problem

We human beings operate as if we existed in a domain of independent entities (reality) that we think we can describe either directly or indirectly through observation or through reason. We think we can abstract the operational coherences of this reality in a way that allows us to make mathematical formalisms that permit us to predict (to compute) future events in the domain in which they take place, or to explain how and why they occur. At the same time rational reflections on how we do what we do show us that even though we may think that for epistemological reasons we need such an independent reality, we cannot claim that we can, in any way, say anything about that which we deem to exist with independence of what we do. Indeed rational reflection shows us that we human beings do not exist in a domain of independent entities and relations, rather we exist in a domain of entities and relations that arise through the operational coherences of our operation as human beings.

The difficulty

Structural determinism

We human beings operate as observers in the implicit understanding that we exist in a domain of operational coherences in which all that occurs, arises as a result of

the interplay of the features and properties that we distinguish in the entities, or elements, that we also distinguish, in this domain. Indeed, we reason and make our predictions, and create our mathematical formalisms based on those operational coherences. We also use these coherences to see whether our formalisms and predictions apply. I call the systems of entities and relations, with which we deal as observers, (of course in the realization of our living) structure determined systems. The elements (components), and the relations between them, that compose a structure determined system constitute its structure. A structure determined system is a system that arises such that all that happens to it or in it, arises in it at every moment determined by the dynamics of its structure. An external agent impinging on a structure determined system only triggers in it structural changes determined in its structure. The agent does not specify the changes in the system.

The observer

We human beings are structure determined systems and operate as such as we operate as observers. Indeed, we find ourselves operating as structure determined systems when we begin to reflect about how we do what we do. When we find ourselves as observers facing a situation or a system in which structural determinism seems to not apply, we are in difficulty. We attempt to recover structural determinism, either by expanding our vision, or by resorting to some probabilistic argumentation that may allow us to recover our confidence that we are after all facing a structurally determined situation.

In all cases we operate as if we were referring to the features of a world or background of reality that existed independently of what we do as observers. We operate as if we could characterize the world because we have access to that background of reality through observing or reasoning. Yet, we cannot do so because we, as living systems, are structure determined systems. Thus, nothing external to us can specify in us what happens in us. External agents impinging on us can only trigger in us structural changes determined in our structure. Instruments do not alter this situation because they themselves are structure determined systems.

Accordingly, we observers (human beings) are structure determined systems and deal only with structure determined systems. It is because of this that we cannot say anything that can be claimed to be a characterization that refers to the features of something as if these features were independent of what we do as we distinguish them.

Structural coupling

As two or more structure determined systems interact recurrently, their respective structures change in a manner determined in themselves, but following a path of change contingent with the moment by moment course followed by their recurrent interactions. The result is that the structures of the systems in recurrent interactions change together congruently until they separate or disintegrate. I call

this process of congruent structural changes through recurrent interactions, that have become recursive in their flow, structural coupling.

An observer that beholds two or more structure determined systems in structural coupling, sees that they behave congruently with each other in the domain in which they remain in structural coupling through their recursive interactions. Furthermore, such congruent behavior appears to the observer as if each participant system was predicting the course of the behavior of the others.

Language

As a biological phenomenon language occurs in the flow of coordination of coordinations of behaviors, or doings, along the realization of the living of languaging living systems. We human beings exist in languaging, all that we do as human beings occur in the flow of our interactions in language. Our operation in language occurs in our recursive interactions in the domain of structural coupling in which we exist as languaging beings. All that we do in language occurs in our operation in the domain of our coordinations of coordinations of doings as living systems, and thus cannot make any reference to an independent reality, even if it seems to us that for epistemological reasons we need reality as a grounding substratum.

That which we call rationality or a rational argument, corresponds to our operation in languaging within the structural coherences of the domain in which we claim to operate through our languaging. Language and reasoning do not violate our operation as structure determined systems. On the contrary language and rationality are our manners of generating metadomains of coordinations of coordinations of doings. These metadomains act as distinctions of relations of coordinations of doings — that is , distinctions on more basic domains of our coordinations of doings — in the different domains of structural coupling in which we operate.

Cognition

The domain of structural coupling in which a living system operates in the realization of its living is also its domain of cognition. In other words, a cognitive domain is a domain of interactions of a living system in which it remains operationally congruent with its circumstance as a result of its history of structural coupling. This of course applies to us as languaging beings and our operation as observers.

The answer

A mathematical formalism specifies a geometry, a matrix of relations in the domain of languaging. Any computation in this matrix of relations necessarily applies to any configuration of operations of the observer, where these operations relate to each other in a manner isomorphic to the matrix of relations or geometry that the mathematical formalism specifies. Thus, whenever one faces a collection

of processes, or a collection of distinctions, or a collection of events that are related to each other, one can find a mathematical formalism that, as a metadomain of coordinations of coordinations of doings, generates a matrix of relations in which the collection of processes, of distinctions, or of events take place. This formal matrix of relations, or geometric space of operations, is isomorphic with the matrix of relations or geometric space in which the processes, distinctions, or events take place.

The effectiveness of mathematical formalisms is the result of our operation in a closed domain of structural coherences in which we generate metadomains of coordinations of coordinations of behaviors or doings — all in the domain of realization of our living, through the realization of our living. Mathematical formalisms do not apply to an independent reality, they apply to the coherences of our living to the extent that they embody configurations of relations that are isomorphic to the operation that we perform as we realize our living.

Natural phenomena are abstractions that we make of the coherences of our operation in language, in the realization of our living, in the domain of structural coupling in which we exist as such. Whenever we make a distinction we distinguish an entity (object, relation, operation, …) through an operation of distinction that entails the relational matrix or the geometric space in which it takes place. And we distinguish what we distinguish as an operation in the domain of structural coupling in which we operate in the realization of our living. We exist in an ever changing epigenic domain of tautological operations in structural coupling defined by our living, in the realization and conservation of our living.

The substratum that we need for epistemological reasons is the no-thingness from which we bring forth things, without needing to talk about it.