Making an IMPACT on the environment: Sustainability Science and the I-School Movement

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ABSTRACT
Understanding how the environment is changing, in a global scale is one of the most important research questions of today. The sheer variety of areas of knowledge required to tackle this question is so great that only a solid interdisciplinary approach can succeed. Sustainability science aims at doing so staying at the intersection of more traditional research areas. The idea behind sustainability science is to develop ways to understand, integrate, and model the interaction between nature and society. The I-School movement is important for that purpose, considering its nature as a source of integration between diverse disciplines and research areas. Focusing mainly on modeling the interactions between nature and society, we opted to use a philosophical point of view to understand the implication s of putting together in a single model society and nature. We used Kant's view of man as phenomena (belonging to nature, being completely causally determined) and as noumena (human being as being free, as a thing in itself) to frame our discussion on how to build models that include both views. We also discuss the problem of integrating opposing views, such as society and nature, in a model, the Tower of Babel problem. We also discuss a common solution to this problem, the Newspeak solution, which is achieved through the imposition of a common ontology to which users are required to conform if they wish to participate at all. Looking for an integration of society and nature in modeling, we tie Gadamer's notion of Play to self-organization as a way to balance, within a single model, two contrary positions. Finally we conclude that a dialogue of clashing views can be held together without devolving into chaos, in which a contradiction implies all propositions, usually thought to be the consequence of bringing together inconsistent positions. This solution points beyond the either/or that is central to the Tower of Babel/Newspeak dilemma. The I-School movement has a unique opportunity to be the place where these discussions occur.

Categories and Subject Descriptors
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Management, Design, Theory.

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1. INTRODUCTION
Global change has been the focus of much debate recently, due to clearly perceivable modifications of Earth's environment and climate. Divergent opinions and controversial research results, along with all the hype usually found in press coverage of this subject, indicate that scientists need to develop a better understanding of the complexity of physical-ecological-anthropogenic systems, developing a perception that the environment is influenced by a multitude of dynamic factors, originated form the interaction of natural and social systems.

Understanding how the environment is changing, in a global scale, is then one of the most important research questions of today. The sheer variety of areas of knowledge required to tackle this question is so great that only a solid interdisciplinary approach can succeed. Newly created fields, such as sustainability science [1, 2], have been gaining space precisely at the intersection of more traditional research areas. The idea behind sustainability science is to develop ways to understand, integrate, and model the interaction between nature and society.

The I-School movement is strategically posed to make a difference in sustainability research, because its multidisciplinary setting can support the understanding, representing and modeling global change, thus supporting the creation, application, and assessment of public policies for the environment. This paper presents a philosophical approach to the understanding of the interactions nature-society. Our belief is that the I-School movement has a unique opportunity to integrate the many disciplines necessary to address this challenge.

We opted to use a philosophical point of view to understand the implication s of putting together in a single model society and

nature. In section 2, we start by using Kant's notion that one can view humans as phenomena, objects of the natural sciences, and as noumena, things in themselves, not to be considered as a part of the causally integrated natural order of Nature. In section 3, we discuss the problem of integrating opposing views, such as society and nature, in a model. This problem was called elsewhere [3] the Tower of Babel problem. We also discuss a common solution to the Tower of Babel problem which is achieved through the imposition of a common ontology to which users are required to conform if they wish to participate at all. Fonseca and Martin [4] call this simplification the Newspeak solution. In section 4, looking for an integration of society and nature in modeling, we tie Gadamer's notion of Play to self-organization as a way to balance, within a single model, two contrary positions. Finally we conclude in section 5 that a dialogue of clashing views can be held together without devolving into chaos, in which a contradiction implies all propositions, usually thought to be the consequence of bringing together inconsistent positions. This solution points beyond the either/or that is central to the Tower of Babel/Newspeak dilemma.

2. PHILOSOPHICAL FOUNDATIONS FOR AN EPISTEMOLOGICAL PLURALISM IN MODELING SOCIETY AND NATURE

Among the many challenges for the I-School movement, one is how to integrate society and nature in the models of nature-society interactions. Next we take a look at some philosophical positions that can serve as a foundation for such models

In order to build scientific models of the interactions between society and nature we need to understand how humans are understood by science. Kant held that human beings could be seen from two complementary perspectives. According to the first perspective, one can view humans as phenomena, objects of the natural sciences, including those social sciences that adopt the methodologies and presuppositions of the sciences of nature. Especially important, here, is Kant's view that the sciences of nature take for granted the principle of causation – enunciated as every change of state is caused. This principle was central to Kant's categories of the understanding, which he believed to be given a priori and necessary to understanding the phenomena of Nature. Indeed, for Kant, Nature consists exclusively of phenomena that appear, either directly in perception, or indirectly, through the mediation of retroductive inference derived from directly given perceptions and previously established knowledge, all integrated and organized in terms of the a priori categories of the understanding.

According to the second perspective, Kant held that human beings, along with every other entity in nature, could also be considered as things in themselves, or noumena. In this case, an entity would not be considered as a part of the causally integrated natural order of Nature. This is possible to do because, according to Kant, the categories of understanding, including the principle of causation, are not derived from experience, but imposed, as presuppositions, upon the things experienced by the mind. Accordingly, it is possible to think of a human being as being free (as a thing in itself) without any self-contradiction, even though as an object of natural science, the same human being must be assumed to be completely causally determined.

In another context, some researchers [5] suggest that there is a hermeneutic connection between noumena and phenomena – agents as produced and as producers. But what are the larger implications of this connection? Fonseca and Martin [4] have suggested that it is possible to frame such fundamental hermeneutic oppositions in terms of the Gadamerian notion of play -- the mediating moment in Gadamerian hermeneutics. They argued that such play is the "place" where the clash between the "Tower of Babel problem" and what they have called its "Newspeak solution" might be addressed. Play allows for the full recognition of temporally distributed dialogue among clashing and mutually inconsistent perspectives, in contrast to such conditions of consistency as are usually associated with essentially atemporal consistent monologues. We suggest that the notion of Gadamerian play may be explicated in a way that brings together the Katian noumenal and phenomenal perspectives, thus giving a theoretical foundation to the creation of models that can held together the two perspectives.

3. THE TOWER OF BABEL PROBLEM AND THE NEWSPEAK SOLUTION

The Tower of Babel problem arises from the assumption that a necessary precondition of communication is the presupposition of a common logical or theoretical framework among those who would communicate. Making this assumption, the Tower of Babel problem might be solved by the imposition of a common ontology to which users are required to conform if they wish to participate at all. But such a maneuver would require considerable oversimplification of the world as it is represented on our models. Fonseca and Martin [4] call this simplification the Newspeak solution, after Orwell's Newspeak -- a revised version of English that was simpler and less capable of expressing different perspectives than traditional English.

The Tower of Babel problem has emerged as a fundamental barrier in the way of developing general and reusable models. The difficulty is that insofar as model designers attempt to accommodate, in the same system, groups of users possessing distinct ontological assumptions, they must address the problem of integrating information in ways that are compatible with the perspectives of all significant stakeholders. Of course, it might be possible to work out ad hoc solutions for a particular, limited set of ontological assumptions, but such a solution would be incompatible with the technological strategy, which aims at general and reusable models. A classic maneuver on the part of model designers is to adopt the Newspeak solution, i.e., when faced with the Tower of Babel problem, force all users to accommodate to a single perspective. In this case, the subtlety and ambiguity of differing perspectives is simply ignored. As in the case of Orwell's novel, implementation of the Newspeak

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solution will likely require administrative authority to ensure that all users conform to the same ontological framework.

Both the Tower of Babel problem and the Newspeak solution share the assumption that communication requires a common underlying logical framework. We reject the relevance of either. Instead, we hold that communication takes place in a tacit and informal setting which is a necessary context, and ultimate source of all explicit, or potentially explicable, formal models. This context also makes negotiation across inconsistent perspectives possible. Such an informal context makes room for communication among persons who hold different perspectives.

A major weakness of the epistemic positions underlying the opposition between the Tower of Babel Problem and its Newspeak Solution is that neither of these positions has any well worked out account of the role of the tacit dimension in knowing. We have seen that both are grounded in what Karl Popper called the "myth of the framework" -- the assumption that communication depends on agreement concerning a common, explicable and logical/theoretical framework. Consequently, there is no account of the process of development and coming to understand of alternative perspectives. If one remains at the level of the fully explicit, it is difficult to see how a difference in points of view might be resolved. If one insists on bringing together inconsistent perspectives or facts, then by a well-known logical consequence, everything follows and the distinction between truth and falsehood is undermined. If on the other hand, in order to save the distinction between truth and error, one refuses to bring together inconsistent perspectives or facts, then one is faced with the choice between recognizing the existence of irreducibly incommensurable domains (relativism), and the elimination, as false, of all domains of facts not consistent with, and thus derivable from, a particular preferred domain (a rather narrow objectivism).

Despite its apparent efficiency, the fundamental problem with the Newspeak solution is that it cannot be implemented in situations where different users are required by the traditions of their own historical contexts to invoke different ontological assumptions. For example, Smith [3] points to the difficulties of integrating accounting systems when different users are required by the historically distinct traditions of case law to utilize different accounting structures. Even the same vocabulary items may have different meanings in different historical contexts. In such cases, differences in user orientation cannot be arbitrarily dismissed. They result from differences of history, which continue to constrain the interpretation of problems and the standards for solutions. They cannot be eliminated by the administrative fiat. Instead, they constitute what Gadamer would call “effective historical consciousness” – a concrete recognition of the effective role of history in constituting horizons from which we view events. In this effective historical consciousness, we become aware that the object is what it is from a perspective that we have arrived at as a result of our own history. But this does not entail a mere relativism. Instead, Gadamer is clear that “it is the task of effective historical consciousness to bring to explicit awareness the historical affinity” between the object of inquiry and the inquirer [6].

Next, in trying to explicate the connection between these two perspectives, we draw inspiration from Kant's Third Critique, the Critique of Judgment. We orient our discussion around Kant's revolutionary notion of self-organizing systems (SOS) – a notion that Kant introduced in order to make sense of living (biological) systems. In so doing, we hope to provide a more systematic relation between Kant's two epistemic perspectives, and with the aid of Gadamerian insights, move toward a third epistemic perspective that gives rise to the notion of wholes in which observers participate as acting and knowing constituents -- both acting and acted upon, both knowing and known.

4. GADAMERIAN PLAY, SELF-ORGANIZING SYSTEMS AND MODELING

It is important to understand that the introduction of Gadamerian hermeneutics at this point entails fundamental reconfigurations of Kant’s notion of SOS. Kant viewed the notion of SOS as a heuristic convenience for the study of biological systems. In contrast, we view the connection between noumena and phenomena in terms of Gadamerian Play -- explicated as a suitably amended SOS. From the perspective of Gadamerian hermeneutics, the SOS that embodies both noumenal and phenomenal moments is viewed as having fundamental ontological, and not merely heuristic, status. In consequence of these considerations, we see the values that direct the design, use, and continuing development of models as not merely subjective, but as dimensions of the SOS (or play) within which models emerge.

To our knowledge, the first thinker to explicitly introduce the notion of self-organization was Kant in the Critique of Judgment. In that work, he uses the idea of self-organization to characterize biological systems. Kant raises the issue of self-organization when addressing the notion of purposes. He is concerned with the notion of a being that is a purpose of nature. As opposed to an axe, which has a purpose only when considered in relation to the humans who create or use it, something, for Kant, is a purpose of nature when it is what it is because of what it is, not because of something else. Or, “I would say, provisionally, that a thing exists as a natural purpose if it is both cause and effect of itself (although [of itself] in two different senses.” [7] Considered as an example of a purpose of nature, a tree, Kant points out that a tree not only produces similar offspring, but it produces itself in that it sustains and furthers its own life. A tree is a self-organizing system. Furthermore, in self-organizing systems, he notes a reciprocal dependence of part and whole. The leaves of a tree are its production and a part of the tree. At the same time, the leaves are necessary for the continued life of the tree as a whole, which may be seen as being caused by the leaves. He concludes with the following definition, “In such a product of nature each part not only exists by means of all the other parts but is also regarded as existing for the sake of the others and of the whole, that is, as an instrument.” Here, the sense of “for the sake of the others” is intended to include the notion of production of the others. “An organized product of nature is one in which everything is a purpose and reciprocally also a means.” [7 p.255].

Current work with the notion of self-organizing or self-producing systems has been explored by Mingers [8], who

discusses the developments introduced by Maturana and Varela (in biology and theoretical psychology), Spencer-Brown (in logic and mathematics), Luhmann (social systems and the law), and their relationships with the epistemological views of Bhaskar (critical realism). Mingers points out that since Winograd and Flores' classic work [9] there has been relatively little done relating information systems modeling with self-organization. Central to Mingers' description of self-organizing systems is the contrast between self-organization and more traditional approaches to self-reference (e.g., Theory of Types). Speaking of the traditional approaches, Mingers holds, "All these approaches are similar in treating self-reference and its paradoxes as something to be avoided. In contrast, autopoietic theory treats these phenomena as central and constitutive of real systems," [8 p.156].

Our introduction of Gadamerian play is precisely in the spirit of Mingers' comments. What Mingers is describing is a system of mutually required oppositions. On the other hand, the play between contrary positions might be essentially self-organizing inasmuch as the paradoxical mutual requiredness is such that each of the two perspectives actually produces one another – asserting what the other presupposes. This, we suggest, is a fundamental link between the philosophic hermeneutics that underlies modeling contrary positions and the theory of self-organizing systems. Gadamerian, hermeneutical play constitutes a self-organizing ontology. Gadamer's notion of consciousness as, one the one hand, historically determined and thus limited, and on other hand, as capable of critical reflection upon those limits and thus free of them makes room for acknowledgment of both the phenomenal and noumenal aspects of the self, respectively.

5. CONCLUSIONS

In this paper we proposed a conceptual view of the possibilities of modeling the interactions of nature and society. This representation is fundamental for sustainability research in a global scale. The integration of diverse disciplines as proposed by the I-School movement put it in a unique position to develop ways to understand, integrate, and model the interaction between nature and society. We opted to discuss the challenges for science presented by the duality of man as being part of nature and having free will at the same time. We used Kant's view of man as phenomena (belonging to nature, being completely causally determined) and as noumena (human being as being free, as a thing in itself) to frame our discussion on how to build models that include both views.

We think that the antagonism of society-nature perspectives can be clarified by using Gadamer notion of Play understood as a self-organizing system. This play applied to modeling opposing perspectives indicates the possibility that support for a given purpose may derive from an antagonistic (contradictory) one. The notion of purpose – "for the sake of" – is thus derived from a larger notion of the self-organizing whole. Clearly, some purposes will prosper while others fail. The ones that prosper are those that are supported by the self-organizing system of which they are a proper part.

Seeking a characterization of Gadamerian play suited to the linguistically oriented hermeneutical situation of modeling society-nature interactions, we have discussed Kant's notion of self-organizing systems and the possibility of integrating noumenal and phenomenal perspectives in the same model. We think that this kind of integration exemplifies the sort of to and fro movement that Gadamer had in mind when describing the fundamental ontology within which understanding takes place. The kind of integration might be a way in which a dialogue of clashing views can be held together without devolving into chaos, in which a contradiction implies all propositions, usually thought to be the consequence of bringing together inconsistent positions. Rather than chaos, the new models created in this way might go on in an interesting and coherent way. In this way, the debate points beyond the either/or that is central to the Tower of Babel/Newspeak dilemma

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