The System of Interpretance, Naturalizing Meaning as Finality

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Abstract: A materialist construction of semiosis requires system embodiment at particular locales, in order to function as systems of interpretance. I propose that we can use a systemic model of scientific measurement to construct a systems view of semiosis. I further suggest that the categories required to understand that process can be used as templates when generalizing to biosemiosis and beyond. The viewpoint I advance here is that of natural philosophy – which, once granted, incurs no principled block to further generalization all the way to pansemiotics – nearer to Peirce's own very general perspective. This project requires a hylozooic framework, which I present in the form of a specification hierarchy, whereby physical dynamics subsume all other transactions at more highly developed integrative levels. The upshot of the paper is a proposal that meanings can be assimilated most generally to final causes.

Key Words: finality, hylozoism, hierarchy, integration, materialism.

Introduction

Natural science, until its confrontation with complexity, had no need for semiotics. Its primary social role after the turn of the Twentieth Century came to be the attempt to control or predict natural phenomena. As a result, its explanatory categories of dyadic action/reaction, used to interpret experiments, have not been able to provide a sufficient basis for semiotic interpretation. In order for Nature to become susceptible to a semiotic analysis, we need to reconstruct our model of the physical-chemical world, as irreducibly triadic. This amounts to a need to incorporate into our accounts of Nature some generalized form of meaning. I suggest in this paper that such meaning can be assimilated to finality.

Then, what is the justification for considering meaning generally to be associated to finality? Why not consider formal causes as well? The reasoning is thus: final cause is the 'why' of events, while formal causes carry the 'how' and 'where', material causes the local 'readiness', and efficient cause the 'when' (Salthe, 2005). It seems clear when choosing among these, that the meaning of an event must be assigned to its final causes. Formal and material causes are merely enabling, while efficient cause only forces or triggers. The example of a cartoon captures some of my meaning here. Two Aliens are standing outside of their spaceship, which has apparently landed on Earth, as we see spruce trees burning all around them in a fire that we infer was triggered by their landing. One of them says: "I know what caused it – there's oxygen on this planet". If we find this amusing, we know implicitly why formality cannot carry the meaning of an event. In natural science formality has been used to model the structure of an investigated system, and so is not suited to carrying its teleo tendencies as well. Formality marks what will happen where, but not also 'why' it happens.

I note as well that the causal approach itself is required if we are trying to extend semiosis pansemiotically to nature in general. Natural science discourse is built around causality, and so attempts to import meaning into it requires it to be assimilated to causation.

Interpretance

We can proceed in this undertaking by generalizing from the most highly developed semiotic system we know of – our own linguistic culture. The principle justifying such an approach is the evolutionary

requirement for antecedent conditions in precursor systems. Nothing can be wholly new in an evolving system, where every phenomenon logically will be a refinement of some ancestral condition. Exceptions to this statement would only be fleeting historical configurations, and these are not represented as such in natural science discourse (Salthe, 2008). Natural science deals in repeatably observable phenomena, not in those by far most common ones that are distinguished primarily by being historically constituted.

From the point of view generally of natural science, Peirce's triad of sign-object-interpretant is too idealized to be operational. A materialist construction of semiosis requires systemic embodiments at particular locales. As constructed in semiotics this would involve a 'system of interpretance' (Salthe, 1998, 2007) – a materially localized embodiment of semiosis.

I begin with a model of the most highly developed semiotic system we know of – scientific measurement. I used this to construct a systems view of semiosis, represented in Figure 1. The figure should be apprehended as a repeating cycle. The categories required to understand the process of measurement, as shown in the figure, can be used as templates when generalizing from linguistically-based semioses like measurement to, e.g., biosemiosis. We can expect that natural phenomena assimilated to the categories shown in the figure must become gradually vaguer and less distinct as separate processes as generalization continues. The process of generalizing moves from particulars to the general. In this context 'general' must be understood as 'more generally present in nature', rather than as semantic generality, as in a declarative statement.

Semiosis is presented in Figure 1 as a developmental process, whereby an interpretant is becoming increasingly more distinct during the developmental cycling of semiosis. A recent scientific investigation supporting a concordant view of perception is found in Furl et al (2007). Development is a moving from some relatively vague precursor toward an ever more definite embodiment (Salthe, 1993) – here, while honing an interpretant. Note the double cycle, one extending outward in abduction to the object, while the other is an internal sequence of induction to deduction and back again after conflation with facts (measurements) deriving from the object. Both cycles work together to refine interpretants. It can be seen, then, that a particular interpretant is being informed simultaneously by both a generalizable sign and by a vague object.

The viewpoint here is that of natural philosophy. From that perspective, there would be no block to further such generalization of semiosis all the way to pansemiotics – that is, to working our way in the direction of Peirce's own very general philosophical perspective. From an evolutionary perspective, biosemiosis necessarily must have emerged from a vaguer pansemiosis, and our human linguistically mediated semioses must be emerging out of biosemioses. Materially, nothing comes from nothing.

Semiosis Naturalized

This project requires a hylozooic framework, which I present in the form of a specification hierarchy (Salthe, 1993, 2002), wherein basic physical dynamics subsume all other transactions at more highly developed ontological /integrative levels. This procedure only makes explicit what we have come long ago to believe, but states it clearly, illuminating various implications. As an example relative to the standard scientifically constructed ontological levels:

{physical realm {material realm {biological realm {sociocultural realm}}}}.

The brackets here are those used in set theory, so the levels are classes and subclasses. Given the above hierarchy, we can then have:

{physical action {chemical transactions {biological sentience {sociopolitical event}}}}

with a particular dynamical example:

{entropy production {free energy decrease {work {economic development}}}}

Work as an obviously purposeful category is usually taken to emerge only at the biological level, and is in this example entrained by sociocultural organization. My statement in this hierarchy is not falsified by there being work not directly afforded by free energy decrease – most work is, and all is at least indirectly dissipative. In this model we represent, in the higher levels:

i) more and more definite phenomena at macroscopic scales
ii) an intensification of existence at these scales
iii) an increase in historicity and path dependency in the higher levels, resulting in increasingly particularized meanings, as well as more robust individuation
iv) an interpenetration of levels – e.g., sociopolitical events will have effects all the way down the hierarchy (thus, warfare will harness increased entropy production, via, e.g., explosives), while restrictions or deficiencies at the lower levels might in some cases interfere with upper level phenomena (e.g., shortage of energy gradient will diminish the rate of economic development or prevent continued warfare)

This hierarchy is formally a subsumption hierarchy, not one of containment. The lower levels subsume all the others – e.g., there can be no marching without legs. As well, as it is composed of 'integrative levels', each higher level in the hierarchy integrates (contextualizes, interprets, regulates, harnesses, organizes) those below it – e.g., legs will not work in unison without rules and superstructures organizing them. As well, marching cannot be 'reduced' to legs moving.

The system is hylozooic because simpler, lower level entities are being organized by the higher levels into forms that they could (but only fleetingly) have assumed before the higher levels had emerged during the universal development of the Big Bang (Salthe, MS). So higher level configurations are states of lower level entities. Thus, for example, anticipatory worry marshals neuronal patterns that entrain chemical reactions, which in turn entrain submicroscopic particulate behaviors, which latter, if we could freeze the system at one microscopic moment, would be occupying particular configurations and associated momenta. At the lowest integrative level, these very configurations would also have had to have been possible, in passing, in the primordial quark-gluon plasma. If that were not the case, then there could have been no material causes of higher level configurations, which, then, would not now be existing. All higher level phenomena were being vaguely prefigured in the primordial system 'back then' – along with many others that have never materialized, on Earth.

Thus, we ourselves, materially, are states or configurations of lower level entities – cells, macromolecules, electrons, and so on. But these are not us. We are integrating them under our own organizational rules. In an internalist sense (Matsuno and Salthe, 2002) we could be said to be the integrative experience itself (semiosis) at a particular locale, as we have been in the process of intending / entraining /attending to that experience.

Moreover, returning to our previous example, marching also integrates leg activities with other forms and habits found in a given ontological level during a given episode at a given locale. Each developed locale is an integrated system of functions – an organism or a city are good examples. An ecosystem or a storm system could serve as less obvious examples. In particular, the storm, by being embodied at no higher than the physico-chemical levels, is more vaguely embodied than are systems at higher integrative levels like organisms. Macroscopic particularity and precision increase as we ascend to higher integrative levels.

Meaning as Finality

The structure of a locale can be parsed using the specification hierarchy. Taking the parade in which marching occurs in the above example, synchronically we have:

{free energy gradients {concentrations of chemical reactants {organisms {enactment of rules in a superstructure}}}}

we could also parse meanings here diachronically, and semiotically, at each level, thus:

{entropy production {free energy decline {striving {celebration}}}}

We may note that all of these can function as final causes – the two in the lowest levels because in a nonequilibrated universe they must happen during any event as a way of furthering universal thermodynamic equilibration (Salthe and Fuhrman, 2005, and below). Each level of meaning integrates the meanings of all the lower levels that subsume it, thereby implying (precisely, conceptually subordinating) them all. Thus, in this example celebration can be taken as the final cause of local entropy production at the lowest level. Entropy production itself is a final cause – by way of entraining anything that can happen to Universal equilibration. The reasoning here is – The Big Bang created an out-of-equilibrium universe because during its expansion, the resulting cooling produced gravitating matter, which in turn went on to form masses and forms, which in some places served as foci for the development of organized systems (Salthe, 2004,a). Each evolutionary step took the system further from thermodynamic equilibrium, the sign of which is the strength of Second Law of thermodynamics. Embodied systems necessarily engage in works of various kinds in order to maintain themselves. This work, because of its poor energy efficiency (Odum, 1983), serves mostly to dissipate energy gradients in the direction of heat energy, and so advances the Universe's tendency towards thermodynamic equilibration proportionally more than it does the intended work.

As argued above, I think it can be proposed that meanings are generally finalities. Yet, since Francis Bacon banned them from science, final causes have not been acknowledged in natural science outside of human intentionality. Nevertheless, they have been surreptitiously present in, for example, the Second Law of thermodynamics, and as fitness increase in neoDarwinian evolutionary theory (i.e., Fisher's 1929 'fundamental theorem of natural selection'), as well as in some interpretations of the 'collapse of the wave function' in quantum mechanics (e.g., Cramer, 1988, Dosch et al, 2005). I would argue that any variational principle (whether maximizing or minimizing) erects a finality in a system described by equations where it controls a variable (as with the Second Law), or where a process can only be modeled if a variable goes to an extreme. In this case the teleology is directly tied to the human process of modeling, but this is really the locus of all teleology, although it is not so apparent in cases not modeled by equations. Yet all discourse resides in human affairs, and all teleology resides in discourse.

A locale is the site of a system of interpretance (Figure 1), which mediates the development of its forms and habits by way of semiosis. These forms and habits are integrated because they appear as refinements of previous forms and behaviors by way of sequences of coordinate interpretants generated by the developmental process, which is labeled as the cycle 'perception' in the figure. Semiosis is thus a developmental process (Salthe, 1998). As such it is finalistic (Salthe, 1993), because guided by signs.

Development in general is a transformation from a relatively vague precursor to a more definite embodiment (Matsuno, 1989, Salthe, 1993). This can be modeled logically as a process of refinement, producing an augmentation of relevant information locally. During semiotic development, meanings (various greater-than-thermodynamic finalities) emerge gradually, and are mutually correlated with coordinate others that are forming simultaneously in the same system at the same integrative level.

The natural philosophy perspective informing this paper can be represented by what we might call a 'Ptolemaic pyramid' (Figure 2), inspection of which will deepen our understanding of this philosophical position (Salthe, 2004,b). The primary fact is the material embeddedness of semiosis at any locale. The figure is 'Ptolemaic' because human semiosis is shown as the center of the Universe [and so I am here implicitly elaborating the Anthropic Principle (Barrow and Tippler, 1986) as well]. The local transactions of semiosis are here viewed as constructing a focal point of (not merely 'in') the Universe -- a developing process subsumed by the entire rest of the Universe.

The pyramid rises up from physical constraints on the left toward human semiosis at the apex, while simultaneously sinking down toward human semiosis from other, larger scale, physical constraints on the right. This peculiar topology is necessitated by the fact that the specification hierarchy, as a subsumptive hierarchy, is logically incompatible with the scale hierarchy, which is a compositional hierarchy. (The contortion in the figure suggests why it is too bad that these hierarchies are not infrequently conflated in various literatures!)

The specification hierarchy is logically a subsumptive hierarchy, where lower integrative levels subsume all higher ones, while higher ones simultaneously contextualize (integrate) all the lower ones under their own rules.

{lower level subsumes --> <-- {higher level contextualizes}}

My use of the Second Law of thermodynamics above is a fine example showing the subsumption of higher integrative levels by the lower, physical, ontological level. Thus, several ecologists have proposed that ecosystems can be understood to be organized so as to maximize the rate at which energy gradients get dissipated (Salthe, 2002, 2004,a). 'Organization' here occurs in the higher integrative levels, where basic thermodynamic imperatives are negotiated into particular kinetic pathways for energy flow. Dewar (2005) has shown that a system that can assume many different configurations will tend to assume one that maximizes its entropy production, establishing rigorously a 'maximum entropy production principle'. Generally (although with some exceptions), increasing dissipation rates will increase entropy production as well, because, even if much of a gradient is captured as exergy during work, faster work is generally less energy efficient. Thus, working harder will marshal more energy gradient, but a greater proportion of the energy flowing through the working system will get lost as entropy. The semiotic import of this can be understood as follows.

The world is very far from thermodynamic equilibrium, and is apprehended locally as (and by) nonequilibrium systems. This can be viewed as a result of the accelerating expansion of the Universe, which resulted in the precipitation of matter, the clumping of masses, and then the shaping of forms, all of which in turn afforded the emergence of organizations in suitable locales. Globally it is this distance from thermodynamic equilibrium which animates the Second Law of thermodynamics. Locally this law is represented by the need to produce at least as much heat energy (entropy) in the service of universal equilibration as might get used to make and support organizations during the dissipation of available energy gradients in works of various kinds (Odum, 1983). Thus we can note that whatever happens in our world is underwritten by the physical propensity for energy gradients to dissipate. And the faster this is done, the better does the energy flow rate (power) of the work involved match, with produced entropy, the ordered results maintained by the accelerated rate of Universal expansion.

In this way we construct the Second Law as a final cause of any activities whatever. The 'meaning' of work at the lowest integrative levels is to support the tendency of the Universe to gain thermodynamic equilibrium. Of course, there would be other finalities involved in many activities – e.g., scratching one's head might have the biological meaning of ejecting lice. Here I assimilate meaning from purpose to function, and, in view of the argument given above, all the way to physical tendencies and propensities. Thus:

{teleomaty {teleonomy {teleology}}} (e.g., Mayr, 1976; O'Grady and Brooks, 1988)

Stated otherwise, the Second Law subsumes all other energy transactions, and, as a finality, participates as well (if only in a vague way) in their meaning. We may note that, while the strong forces of higher level finalities may come and go locally, and may cancel each other out, this lowest level finality, weak as it is at the higher levels, is always in effect, always 'inviting' energy dissipation at the greatest rate possible locally (Dewar, 2005).

Explicating further on the differences between the two kinds of hierarchies, the scale hierarchy (Salthe, 1985, 2002) is logically a compositional hierarchy, wherein the higher levels contextualize (in some cases as a result of containing, as organisms contain cells) the lower ones. The specification hierarchy, of interest here in this discussion of finality, is a branching structure from the lowest level upwards. So most of the hierarchies shown in the text above would represent just one branch in our multiple world. Other branches would, of course, have the same lower levels. The specification hierarchy's logic is that of set theory, which is why the integrative levels are represented as classes and subclasses in the above text. The scale hierarchy is a form showing regulation of the smallest by the largest and slowest changing – of any kind, ranging from commands (which are of virtual scale), to rates of change. In any material system slow processes contextualize and therefore regulate faster ones.

Interestingly from the point of view of semiosis, a command hierarchy can have an interpretation using the specification hierarchy as well. Here subsumption connects closely to finality. For example, as I witnessed in the military, a major might suggest that something ought to be done soon. Then a lieutenant will add that this should be done on a particular day. Following this a sergeant will deploy the troops at a particular time in a particular formation on that day. It is in this spirit that the Second Law works in the above discussions. Thus, we could assert that I would not be typing this paper if the Second Law were not being activated by the fact that the universe has become very far from thermodynamic equilibrium. But in the spirit of our cultural disposition, it might be asked, "So what? What can we do with this?" My answer for the present is, "Just let it seep into your consciousness. It may explain more of our behavior than we suppose at present."

Conclusion

The present attempt to generalize – that is in effect to naturalize – meaning requires us to embed it materially in the natural world. This leads us to find it to be most generally, or pansemiotically, located in final causes.

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Figure Captions

Figure 1: Human semiosis (e.g., measurement) as a double cycle. Note that the sign is shown partly in the system of interpretance and partly external to it, as it is a co-construction of both object and system of interpretance. The circle demarcates semiosis, the oval the embodied system of interpretance. For a simple example, let (1) be snow, (2) 20ºF, or aching fingers, and (3) 'cold'. It may be noted that the assignments of 1, 2, 3 differ from Peirce (CP 2:274) by being rotated clockwise in the figure. The reason is that Peirce's general assignments appear not to be intelligible in the context of a materialized system of interpretance. In particular, in that context it is inconceivable that signs would be Firsts, or that interpretants would be Thirds.

Figure 2: Embedded semiosis. This is a conceptual pyramid with a strange topology, rising up toward the viewer on the left hand side, while dipping down from the viewer on the right hand side, as seen from above. It combines a specification hierarchy, {physical {material {biological {sociocultural observation}}}}, with a scale hierarchy, [climate [hydrology [physiology [cognition [neuron depolarization [chemical reactions [temperature]]]]]]], with the smallest relevant scale at the left in the figure and the largest on the right.

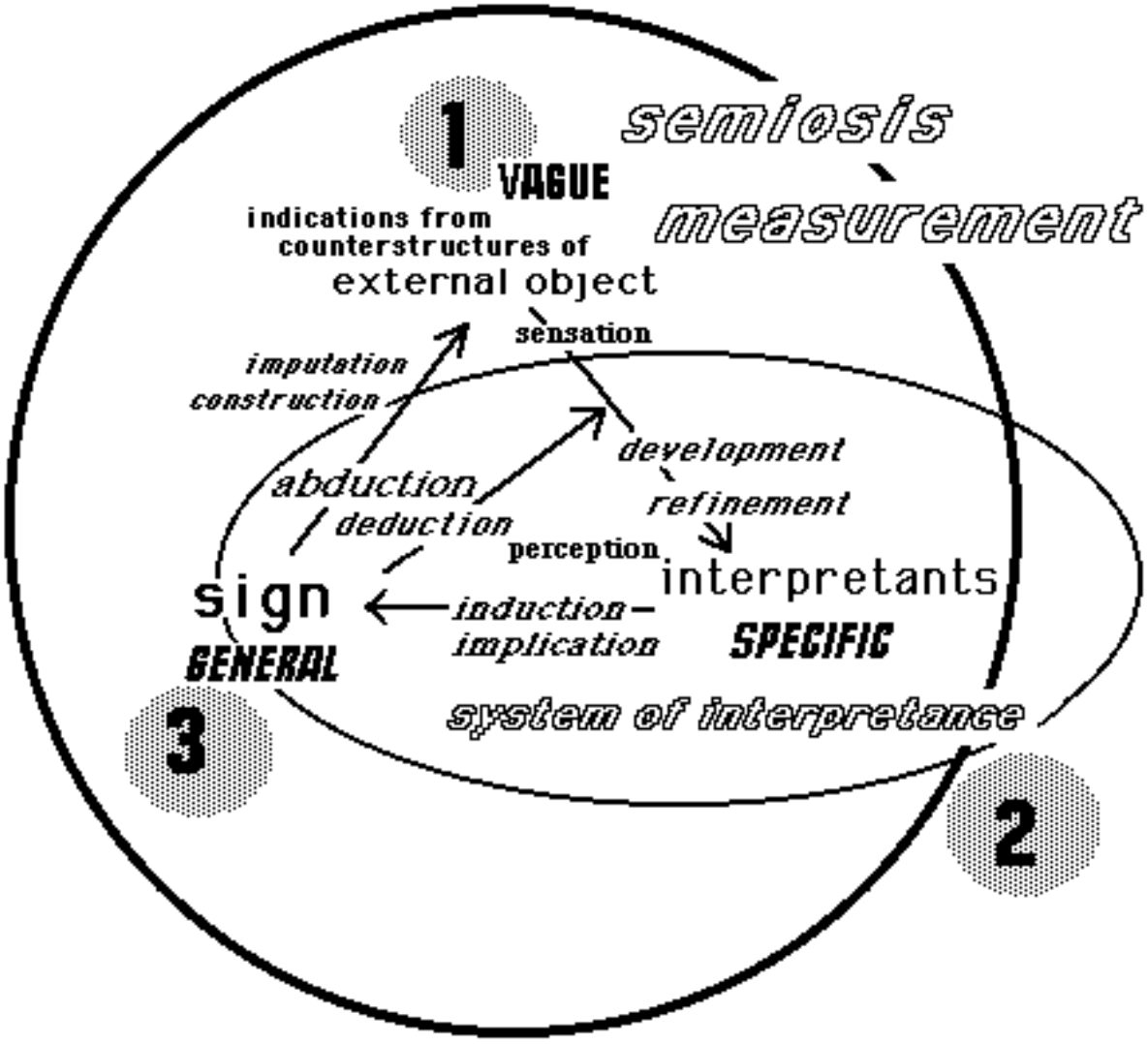
1
VAGUE
semiosis
measurement
indications from
counterstructures of
external object
sensation
imputation
construction
development
refinement
abduction
deduction
perception
interpretants
sign
induction–
implication
SPECIFIC
GENERAL
system of interpretance
3
2

Figure 1

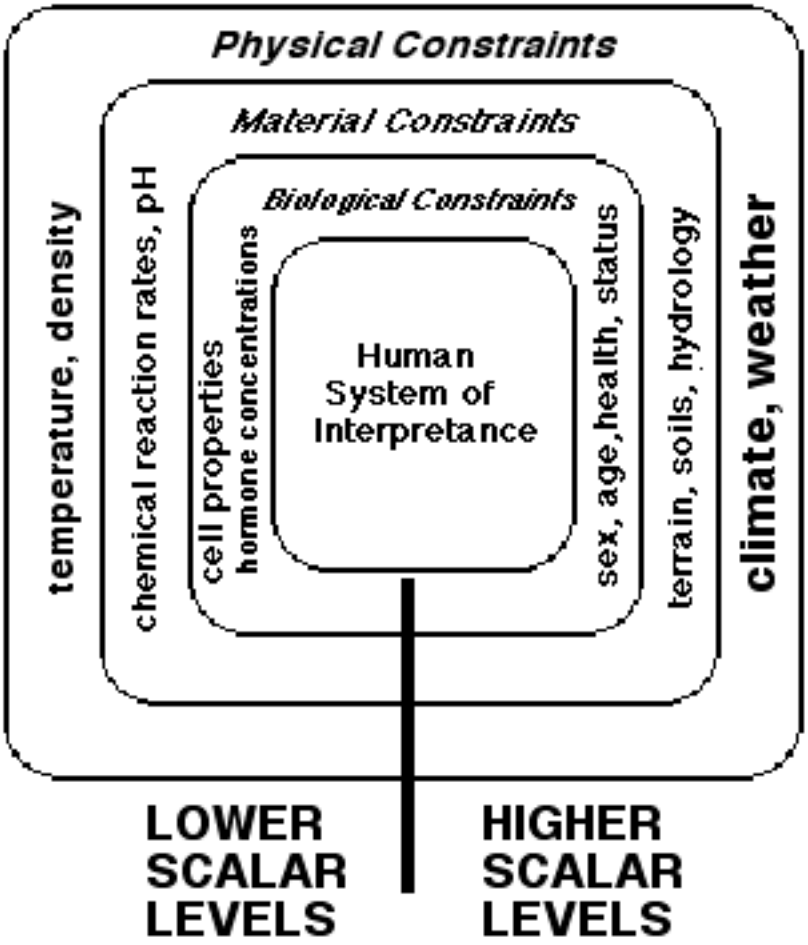
Physical Constraints
Material Constraints
Biological Constraints
temperature, density
chemical reaction rates, pH
cell properties
hormone concentrations
Human
System of
Interpretance
sex, age, health, status
terrain, soils, hydrology
climate, weather
LOWER
SCALAR
LEVELS
HIGHER
SCALAR
LEVELS

Figure 2