

IS THERE A KNOWLEDGE ENVIRONMENT?

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ABSTRACT

The analogy between the physical world and that of knowledge enables us to speak of the "knowledge environment" and discuss various environmental problems of great significance. However, analogies can be misleading if they are not based on systemic relationships. In this paper we take the three worlds, physical, mental, and world 3, as defined by Popper, and analyse them in a common systemic framework. In particular we discuss the use of the term "living organism" in relation to the three worlds. We conclude that the metaphor of a knowledge environment does have an underlying systemic model which can be formalized as required. The analysis also applies to the world of subjective experience and gives a common foundation for ecological notions such as pollution in the worlds of biology, the mind and ideas.

OBJECTIVES

We note the attractions of treating the information world as distinct from the physical and mental worlds, yet having the same ontological status.

The growth of human knowledge presents major opportunities in terms of the availability of information and expertise relating to the solution of world problems. However, increasingly many world problems have been generated by this same growth of knowledge. This dilemma has been detailed by Jerzy Wojcienchowski (1978) who sees "Knowledge as a source of problems", and Emil Dudik (1981) who asks, "Can human knowledge tolerate human survival?"

Aristide Esser (1981) has suggested that we consider human knowledge as an **environment** on par with the physical environment and develops the analogy

between ecological considerations in the physical environment and those in the knowledge environment. The preservation of an effective relationship between the human race and the physical environment has become accepted as a high priority in recent years. It is argued that similar attention needs to be paid to the relationship with the knowledge environment if our socio-cultural system is to survive.

In this paper we attempt to analyse some systemic aspects of the proposals of these three authors, particularly the view that they present of knowledge as an environment on a par with the physical environment. This may appear reasonable to some people but not to others. In a paper at the AAAS meeting last year we illustrated the distinct ontology of the knowledge environment by discussing a computer-based library system actively continuing to acquire and develop knowledge after the human race had gone. A questioner had difficulty with this, ultimately resolved as an objection to this happening. We assured her that, in the same way as the suggestion of nuclear fission was not to be taken as a suggestion also that we annihilate ourselves, neither was the discussion of a library without people a recommendation to do without people.

However, the view of knowledge as having independent existence from people and its own autonomy has significant attractions if we are to consider the problems of this information age. The dangers of something are more obvious if it is seen not just as the creation of our own minds, and hence under our own control and pliable to our whims. The move from idealism to realism at the end of the nineteenth century may be seen just as much as the birth of technology as having been derived from the success of technology. We first came to fear the physical world, then to tame it, and to remould it. More recently we have

come to realize what we may be losing in this process and to understand the possibilities for harmonious co-existence with our physical environment. That realization may well have come too late -- we have changed too much. Our unbalanced, human-centred and positivist view of the world of knowledge compared with that of the Greek enlightenment shows similar problems and dangers.

It seems possible that this shift from idealism to realism and technology will be paralleled by a similar change in our attitude to the knowledge environment during the next twenty years. The end of the twentieth century may mark the birth of a new realism that sees the recognition of the status of the knowledge environment as a distinct world separate from, and explored by the human mind, rather than created by it. Whatever one's views on the **reality** of such a separation, it should be a useful one in exploring the technologies and the dangers of the "knowledge construct."

Our own systems ideology is essentially pluralism of the form George Kelly (1955) calls **constructive alternativism** and Magoroh Maruyama calls **polyocular** (1980). We see the need to be able to look at a system from distinct viewpoints, to be able to move freely between them, and to be able to compare them without confusion. The validity of any particular viewpoint is a function of our purpose in assuming it, and both purpose and validity are legitimate topics for systemic discussion.

ECOLOGY OF KNOWLEDGE

We note that the domain of application of the term "ecology" has been widened to apply to non-living systems and query whether this is a literary device or a systemic analogy.

The term **ecology** is a neologism for "oecology" coined in the late nineteenth century from the Greek word for dwelling and used in biology to cover the sciences concerned with the economy of plants and animals; in particular, their interactions with their habitats. The systemic nature of this concept has been recognized in more recent coinings of "ecosystem" to subsume communities of organisms together with their environment, and "ecodynamics" as Kenneth Boulding's (1978) term for the systemic

mechanisms underlying the evolution of societies.

Like many a powerful systemic notion, that of ecology has become generalized though the widening of its scope to include more abstract notions of an organism and its habitat, as for example in Gregory Bateson's (1973) **Ecology of Mind** where the "mind" is viewed as an environment for "ideas" playing the roles of organisms. Recently the term **ecology of knowledge** has become used to capture the way in which "knowledge" in its own right provides an "environment" for the mind and for human society (Esser 1981). The economics of the knowledge environment, and the interplay between man as a user of knowledge taking from this environment, and man as a creator of knowledge contributing to this environment, are useful concepts with which to model aspects of modern informational society.

However, valuable systemic concepts can be so stretched beyond their range of convenience as to break down and become meaningless. They can become vague analogies that obfuscate rather than elucidate. For example, Varela (1981) has objected to the widening of the concept of **autopoiesis** from its original application to the cell to apply to complete social structures for just this reason. It seems also just such an objection to our tendency to encourage such widening in general systems theory that provoked Berlinski's (1976) critique and Jacques Monod's (1974) remark of GST that, "if it existed, it would be meaningless."

Thus we should examine the legitimacy and the utility of widening the term ecology to cover both that of mind and that of knowledge. We should not expect any simple answer, that it is legitimate or not, useful or not, for these dimensions of evaluation are both continuous and relative to value systems that are dependent upon our objectives. In the following sections we use the systemic tools that have proved so useful in similar analyses, and which we have developed in a general framework in previous papers: that of deriving the systems of **constructs** used or **distinctions** made in discussing ecology in biology. We then translate these to alternative frameworks defining mind and knowledge to examine their wider significance.

For our definitions of **mind** and **knowledge**, two not uncontentious notions in their own right, we use Karl Popper's (1974) definitions of **three worlds** as we have developed it in recent papers (Gaines & Shaw 1981, Gaines 1983). This has proved fruitful in providing a model for the socio-cultural influences upon the formation of the construct systems in the minds of individuals (Shaw & Gaines 1981) and also in modelling the role of the computer as a vehicle to explore the worlds of knowledge (Gaines 1979). Hence, it seems likely to provide an adequate framework for the discussion of mind and knowledge in the context of information systems.

As a final remark to this section let us note the multi-level nature of this enquiry and the confusions that can arise thereby. The separation into **worlds** is itself the result of distinctions which are as conventional and variable as those of any construct system. In particular the boundaries of what is being analysed can slip without our realizing this. In addition the chains of effect that we study pass through several worlds so that phenomena in one affect value systems in another. Hence when we study such a term as "pollutant" we have to be careful to distinguish between systemic and linguistic widening of its application. The systemic role of a pollutant in the physical world having a systemic analogy in world 3 would legitimate the use of the term in the context of knowledge. However, we might also "legitimately" use the term in this context because a phenomena in world 3 can give rise to actual pollution of world 1. We have much scope for metonymy and other forms of literary device. Thus, " $E=MC^2$ kills", is a legitimate play on words but not what we are looking for. Metaphor is a key process in scientific innovation but needs to be followed by critical rationalism.

THREE WORLDS

We note that the idealism/realism debate as to the relations between world 2 and world 1 is not yet ended and suggest that the equivalent world 2/world 3 debate will be equally lasting, difficult and rewarding.

Popper's (1974) distinction between "3 worlds" seems a particularly useful

one to make in considering the analogy between the ecology of the biological world and that of knowledge. He notes:

"If we call the world of 'things' - of physical objects - the **first world** and the world of subjective experience the **second world** we may call the world of statements in themselves the **third world** (...world 3)."

Popper's definition is essentially extensional and expressed through exemplars rather than acceptance criteria. The intensional forms of the distinctions made between worlds are not easy to derive -- if they were, much of philosophy would disappear.

Part of the difficulty in deriving intensional definitions is that all our distinctions at this level seem extremely self-centred, certainly people-centred. The difficulty of defining criteria for the physical world, of going beyond naive realism, to some foundational principles with which to capture the essence of reality are well known. Cartesian scepticism as an answer makes self central -- "Cogito, ergo sum." The critical approach through dialectics also founders on the question of initial distinctions, resorting to Hegelian "self reflecting on self." Positivist phenomenology seeks to give inter-subjective criteria for shared sensation, or replicated sensation patterns, but it is still **our** sensations that determine physical reality.

This precedence of world 2 over world 1 at a rational level seems to be reversed at an intuitive level. We know that the physical world is there in a way that defies rationality. Unfortunately, there are many things that we "know" that turn out to be untrue. Faith is only to be trusted when it actually moves mountains and then only after exhaustive investigation.

These problems of world 1 in relation to world 2 are well established - the subtle commonsense arguments of Broad and the robust refutations of sophistry by Wittgenstein correspond to our intuition but have not been underpinned by our logic. The analogous problems of world 3 in relation to world 1 are less well debated. Popper (1974) states:

"I regard the third world as being essentially the product of the human

mind. It is we who create third-world objects."

However, having been created, they then exist -- they have an ontological continuity independent of their creators:

"That these objects have their own inherent or autonomous laws which create unintended and unforeseeable consequences is only one instance (although a very interesting one) of a more general rule, the rule that all our actions have such consequences."

Popper does not raise the question for world 3 whose answer is so difficult for world 1: "what is the ontological status of 'statements in themselves' before they become products of the human mind?" If we ask, "does the physical world exist before we experience it?", then the answer is "yes" and any other is taken as sophistry, albeit legitimate in that following the "no" path explores the boundaries of our own collective rationality. If we ask, "do statements in themselves exist before we think them", then the answer is "no" and any other is taken as sophistry, albeit legitimate in that following the "yes" path explores the boundaries of our own collective rationality.

This asymmetry between worlds 1 and 3 is highlighted by recurrent arguments that world 1 has a similar ontological status to that which Popper ascribes to world 3. In recent years increasing evidence for the constructive nature of the foundations of particle physics has led to a convergence between the Tantric view of reality as *maya* and those of some physicists (Talbot 1981). Wigner (1967) suggests that world 1 is secondary and relative to world 2:

"there are two kinds of reality or existence: the existence of my consciousness and the reality or existence of everything else. This latter reality is not absolute but only relative."

He goes on to suggest a rationale for the second, world 1, form of reality having become so dominant, particularly in Western society:

"The only explanation that I can conceive for this is that mankind was, for a long time, engaged in an intense struggle for survival and everyone had to concentrate his attention on the

external, inimical forces. We learned somehow that our consciousness is extinguished unless we undertake certain actions and these actions, and the preparation for them, claimed all our attention."

Wigner's views on the origins of our preoccupation with world 1 are reminiscent of those of Jaynes (1976) in attributing consciousness to the breakdown of the bicameral mind through cataclysm about 3,000 years ago. It is interesting to speculate in relation to this and MacLean's (1975) triune brain model about the basis of a similar switch of attention to the world 3 knowledge environment -- perhaps not a change in physiology but instead the computer acting as a prosthetic brain (Gray, Gray & Esser 1980).

A precedence of world 2 over world 1 is often taken to lead to ridiculous possibilities -- if reality is illusory why cannot we choose which one to experience? This question may be answered in many ways at many levels. One of the best answers is that of Jorge Luis Borges (1941) in his story of *Tlon* where minds do create matter, but where 'rules of the game' still prevail. In another fictional presentation Piers Anthony (1982) gives us a feeling not only for self-alienation through alien perception of ourselves, but also for the social dynamics of a world in which the survival of self beyond its physical manifestation is taken for granted. In neither case does the possibility of choosing the rules of the world imply that, once chosen, they are varied at whim. Poetically or religiously, one might say that the choice not to choose again, once the rules are chosen, is precisely the choice that creates the world as we know it.

These notes may be seen as continuing a debate that has been going on for over 2,000 years between various forms of idealism and realism. Recent developments are interesting: firstly in showing a swing back to idealism; secondly in providing an explanation for the priority of realism outside the usual context of "respect for science"; and thirdly for linking these first two phenomena into the phylogenesis of the brain on the one hand and the basis of physical phenomena on the other. The fictional works also indicate that idealism need not lead to either chaos or solipsism.

However the world 1/world 2 debate still being in full swing must cast doubts on any attempt to give deeper underpinning to the world 1/world 3 analogy that leads to notions of the ecology of knowledge. In particular neither world 1 nor world 3 seems separable from world 2, so we have to consider the problem of the ecology of mind also. In the next section we attempt to give a systemic analysis of the three worlds which will serve as a foundation for all these endeavours.

THE DISTINCTIONS LEADING TO THREE WORLDS

We note that a simple premise together with dubious inferences gives us a set of distinctions defining the 3 worlds.

In the following discussion we shall define Popper's three worlds by minimal distinctions necessary to generate them. In doing this, and in the development that ensues, we shall be guilty of a number of steps of reasoning that are blatantly fallacious by certain criteria. However, our overall position is conventionalistic and takes each of these false/true steps as being a bifurcation opportunity for generating various flavors of philosophy. So bear with us as we skate over a great deal of very thin ice. The choice of where to fall in is part of our argument.

The fundamental postulate is that:

FP There exists distinction-making, some necessary.

This traps us (through ontological fallacies) into:

W3 There exist distinctions -- world 3

W2 There exist distinction makers -- world 2

W1 There exists a source for necessary distinctions -- world 1

The worlds arise through a similar chain of reasoning that since something exists it must exist somewhere. To term them all "worlds" hides a category error that undoes much of the beautiful analyses of Kant, Hegel and Peirce. However, the choice is open - as we have noted before (Gaines & Shaw 1981), "to refuse to allow a distinction is also a meaningful

action...It does not allow changes in oneself, the world and others." It is useful to flatten the categories for the moment, and regard them as all being at the same level.

What we have at the end of this chain of 'reasoning' is a reasonably neat systemic framework for the three worlds. It seems capable of being re-organized to match any metaphysical foundations. For example, the Cartesian argument doubts all, intuitively FP through desperation, derives W2 first through egocentricity, then gets W3 from what is thought and W1 from what is "am". The Hegelian problem is to justify FP -- that we need not do for the purposes of this paper.

This definition of the three worlds through generative distinctions has proved useful in analysing a range of philosophical, theological, psychological and physical arguments. For example, the ascription of "reality" to "necessity" in defining world 1 goes back to the notion of the real world as that of absolute essences. However, in psychological terms it models the reification of that which we take to be necessary, given phenomena outside our minds and beyond our choice. Accepted dogma that controls our actions becomes as much part of the physical world as gravity. We bump into a wall and it hurts us. We bump into a superordinate moral imperative and it hurts us. We cannot see through the wall but neither can we see through our own missing constructs. Much of reality is validated by not being tested or by being tested in such a way that it cannot fail to be validated.

The system of distinctions in the definitions can be developed further on a formal basis through a calculus of distinctions. However, for the purposes of this session we shall concentrate on semantics rather than syntax and attempt to use the definitions to examine the notions of ecology when transferred from world 1 to worlds 2 and 3.

ECOLOGY IN THREE WORLDS

We note that systemic definitions of ecological terms transfer meaningfully to the worlds of the mind and of ideas.

Ecology is concerned with living organisms and their interactions with

their habitats. The definition of a living organism is notoriously difficult -- we shall adopt an abstraction of the notion of autopoietic unity (Varela 1979):

BO A biological organism is a coherent, autonomous physical entity.

We can take out the world 1 connotation by dropping "physical":

LO A living entity (organism) is a coherent, autonomous entity.

This can be given a formal definition by noting that: an entity is a distinguished part of a world; a coherent entity is one that is relatively stable in that the relations of its parts one with another are more stable than with those outside it; an autonomous entity is one which is relatively uncontrollable in that the relations of its parts to those outside it are less stable than the relations of parts outside it with one another. Stability can be formalized in relation to pair of distinctions in opposition except for unstable entities, and opposition can be formalized as pairs of distinctions distinguished by never both marking the same entity.

Thus we can define the entities of interest in world 1 in systemic terms which can be carried over to worlds 2 and 3 by replacing the term "physical" in BO with the appropriate term. An organism in world 2 is then a coherent autonomous distinction-making entity, a society at one level or a mind at a lower level. Since in biological terms we seem to choose some minimal entity as our basic organism, mind seems the appropriate analogy in world 2. We define a mind organism as:

MO A mind organism is a coherent, autonomous distinction-making entity.

This is also a definition of Pask's (1975) P-Individuals using Kelly's (1955) notion of personal construct systems (Shaw 1980, Shaw & Gaines 1981). The ecological notion of a species in world 1 is now analogous to that of a society in world 2. Note that this is "society" stripped of all its correlated connotations in worlds 1 and 3.

An organism in world 3 is a coherent autonomous distinction-being entity, a theory, ethos, art-form or mythology at one level or a theorem, culture, work

of art or myth at a lower level. Naming a minimal entity which is a class term for such as these is difficult. We shall revert back to the pre-Platonic meaning of "idea" as a system of distinctions -- later to be associated by Descartes with such systems as manifested in the mind. We define an idea organism as:

IO An idea organism is a coherent, autonomous distinction-being entity.

The difficulty with this definition is the notion of autonomy in the world of ideas seen as systems of distinctions. At some stage in our cultural development we seem to have lost a feeling for Plato's world of ideas and to find the concept of autonomous ideas independent of ourselves repugnant or absurd. It may be both of these but it is formalizable and often re-surfaces as in Mather's (1964) natural selection of autonomous ideas and Bateson's (1973 p.21) ecological questions: "How do ideas interact", and so on. The notion of a world of autonomous ideas is a useful model with which to deal with some of the phenomena documented by Robert Merton (1973): simultaneous independent discoveries, a high degree of unpredictability as to the actual mind in which they will manifest, and so on. The ecological notion of a species in world 1 is now analogous to that of a culture in world 3 -- again a culture bereft of correlated connotations in worlds 1 and 2, and known abstractly in terms of the distinctions defining it rather than Edward Hall's (1959) formal, informal and technical mechanisms whereby distinctions mould minds.

We note incidently that these definitions of organisms as autopoietic unities in worlds 1, 2 and 3, seem to resolve the conflict noted by Varela (1981) in the widening of the term autopoiesis. Maturana's (1975) original definition is essentially, as Varela notes, in world 1, BO above. Zeleny's (1977) social autopoiesis is in world 2, MO above. Pask's (1981) organizational closure is a world 3 notion relating to the coherence of systems of distinction, IO above. Life operates in all three worlds and is autopoietic in all three. It is an open question as to whether there exist life processes that do not manifest in all three worlds simultaneously. Open, not necessarily in the sense of being resolvable, but open to choice as we make, or choose not to

make, the distinctions which themselves form the three worlds.

Having established definitions of worlds and living organisms within them, we can readily incorporate other ecological constructs by carrying over their systemic definitions in world 1 to worlds 2 and 3. A pollutant is that which makes an environment less habitable for a species, and hence is an entity which undermines autopoiesis, and hence is a relative stability decreasing and a relative controllability increasing factor. Using these concepts, we can give formal definitions of those pollutant entities in world 2 that can undermine the autopoiesis of the mind, such as the distinction-making systems of schizophrenia. We can also give formal definitions of those pollutant entities in world 2 that can undermine the autopoiesis of an idea such as Russell's paradox in naive set theory -- the theory of types is an anti-pollution device in world 3.

Similarly Ardrey's (1966) construct of territory as that which is defended carries over into worlds 2 and 3. We see battles between P-Individuals which result in one being "killed" by being permanently replaced by another, e.g. the stranger being absorbed into a culture, or result in one being "driven off" but still having the possibility of returning, e.g. sublimation. The construct of an ecological niche seems as appropriate to the evolution of societies and cultures as it is to that of biological species. Notions of resource as unused potential and energy as a releasable potential for change are also applicable in all three worlds. There is a rich systemic analogy available of which the notion "the ecology of knowledge" is a significant part.

CONCLUSIONS

This paper has given sufficient formal foundations for an ecology of knowledge to show that the metaphor does have a rich systemic underpinning. However, we have also shown that to develop it in depth opens up a Pandora's box of philosophical questions that have become unfashionable rather than answered. The problems of the ecology of mind and of the knowledge environment are major ones for our time that require at least as much attention as those of the physical

environment. We hope this joint session of the Society for General Systems Research and the Association for Man-Environment Relations will be the first of many attempting to focus on these issues and provide systemic models to aid their solution.

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