Epistemological unification of the disciplines: the contributions of sociocybernetics

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Abstract

In order to develop transdisciplinary working across the disciplines, clear epistemological foundations are required. Without these, even simplistic approaches to interdisciplinarity are likely to fail. Our proposal is that sociocybernetics promises to provide the required unifying metadisciplinary epistemological foundations and transdisciplinary frameworks. We note that second order cybernetics provides a metadisciplinary framework for discerning the causes and cures for the schisms within the natural and cognitive sciences. The particular contributions of sociocybernetics are to (i) extend the second order understandings to unify the social sciences and (ii) by incorporating extant sociological theory back into the transdisciplinary pursuits of cybernetics and systems theory to enlighten and enrich those pursuits. In order to highlight the power and fruitfulness of these contributions from sociocybernetics, we problematise, deconstruct and reconstruct key concepts concerned with human communication. To do this, we take as central the question, "What is a symbol?"

Key words sociocybernetics, second order cybernetics, transdisciplinarity, metadisciplinarity, symbol

Résumé

Si les disciplines veulent promouvoir la transdisciplinarité, il importe que leurs efforts soient fondés sur des bases épistémologiques clairement énoncées. Sinon, même les tentatives les plus simples d'interdisciplinarité sont vouées à l'échec. Nous tenterons de montrer que la sociocybernétique est en mesure de fournir les bases épistémologiques métadisciplinaires ainsi que l'encadrement transdisciplinaire dont nous avons besoin pour faciliter l'unification jugée souhaitable. En effet, la cybernétique du second ordre propose un cadre métadisciplinaire susceptible d'éclairer notre compréhension des causes des nombreux schismes observés dans les sciences de la nature et les sciences cognitives et de nous guider dans la recherche des moyens pour y remédier. La sociocybernétique peut surtout contribuer: (i) à approfondir notre compréhension des phénomènes du second ordre pour faciliter l'unification à l'intérieur des sciences sociales, et (ii) à réinscrire les théories sociologiques existantes à l'intérieur des efforts de transdisciplinarité déployés en cybernétique et en théorie des systèmes, permettant ainsi d'éclaircir et de renforcer ces efforts. Afin de mettre en évidence le caractère puissant et fructueux d'une telle contribution de la sociocybernétique, nous aborderons un certain nombre de concepts clés se rapportant à la communication interhumaine en reformulant la problématique à l'intérieur de laquelle ils se situent, pour ensuite les déconstruire et les reconstruire. La question qui se pose au coeur de notre démarche est la suivante: « Qu'est-ce qu'un symbole ? »

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Mots clés : sociocybernétique, cybernétique du second ordre, transdisciplinarité, métadisciplinarité, symbole.

1. Introduction

In order to develop transdisciplinary working across the disciplines, clear epistemological foundations are required. Without these, even simplistic approaches to interdisciplinarity are likely to fail. This is because, as currently conceived and practiced, not only are there perceived to be large differences between disciplines, there are also perceived differences within disciplines. As examples, we cite the different paradigms operating within the natural sciences, the cognitive sciences and the social sciences. We also note the continuing apparent oppositions that divide the humanities from the sciences generally. Our proposal is that sociocybernetics, as currently being developed, promises to provide the required unifying metadisciplinary epistemological foundations and associated transdisciplinary frameworks. Our analysis is as follows. We acknowledge the unifying role of cybernetics and systems theory for the first order approaches that are taken within all the scientific disciplines. We also note that second order cybernetics provides a satisfying metadisciplinary framework for discerning the causes and cures for the schisms within the natural and cognitive sciences. This satisfying epistemological clarity exists precisely because second order cybernetics uses the rationally conceived concepts and models developed within first order science to, in von Foerster's (2002) phrase, "explain the observer to himself".

The particular contributions of sociocybernetics are to (i) extend the second order understandings to enlighten and unify the social sciences and (ii) by incorporating extant sociological theory back into the transdisciplinary pursuits of cybernetics and systems theory to, in turn, enlighten and enrich those transdisciplinary pursuits. Our core thesis is that in order to appreciate the power and fruitfulness of these peculiarly sociocybernetic transdisciplinary pursuits, one has to problematise, deconstruct and reconstruct key concepts. This has largely been the strategy adopted by von Foerster and Maturana (amongst others) to develop second order cybernetics. Our sociocybernetic enrichment problematises, deconstructs and reconstructs the central concepts concerned with human communication ('information', 'communication', 'signification', 'language'/'languaging'). To do this, we take as central the question, "What is a symbol?" Our scholarly exegesis also includes what we believe are satisfying ways of interpreting and reconciling the several influential theoretical approaches that have contributed to our understanding of human communication. This paper is, in part, the fruit of many years of debate and discussion between the two authors. We are aware that the paper attempts to cover much in a short space. It draws directly on papers thus far separately published (Scott, 2002, 2004; Shurville, 1993, forthcoming). The reader is referred to these for elaboration of the arguments presented.

The paper is organised as follows. First there is a brief discussion of the meanings of the terms 'interdisciplinarity', 'transdisciplinarity' and 'metadisciplinarity', together with an overview of what so far have been the contributions of cybernetics. We then consider the particular contributions of second order cybernetics and place these in the context of the development of sociocybernetics as a research programme. We then address the topic of human communication and our central question, "What is a symbol?", focusing on the controversies that have arisen in cognitive science and setting out our sociocybernetic transdisciplinary analysis. We end with some concluding comments that include some suggestions about how to characterise the differences between the sciences and the humanities in a way which invites mutual respect and shared understandings in place of the distrust and misunderstandings that are so commonly experienced.

2. Interdisciplinarity, transdisciplinarity, metadisciplinarity: the contributions of cybernetics and systems theory

The terms interdisciplinarity, transdisciplinarity and metadisciplinarity are frequently used in differing and overlapping ways. Our view is that cybernetics as it was formulated by its founders as a metadiscipline with the aim, not only of fostering collaboration between disciplines (interdisciplinarity), but also of sharing knowledge across disciplines (transdisciplinarity). As a metadiscipline, cybernetics comments on forms of knowing (the cognitive processes and communicative practices of observers) and also on forms of knowledge (for example, similarities and differences between different discipline areas). The distinction between first and second order forms of cybernetics was introduced by von Foerster in 1974 (see von Foerster, 2002) to mark the reflexive nature of cybernetics as a metadiscipline: first order cybernetics is the study of observed systems, second order study is the study of observing systems.

We elaborate on these distinctions:

1. By interdisciplinarity is meant the use of the "language" of cybernetics (formal concepts and associated terminology) to build bridges between different knowledge domains (Latin "inter" - between). An example is the concept of control by negative feedback and the associated terminology. The concept as a model may be applied in many different domains. Indeed, a major motivation for the founding of cybernetics was that this was the case. Engineers, anthropologists, neurologists, psychologists and economists (to name some) were constructing "similar" models, albeit with different domains of application and terminology. Thus cybernetics as a lingua franca serves to facilitate communication and exchange of models between discipline areas.

2. By transdisciplinarity, we mean the case where the models and terminology of cybernetics become systematized as a set of inter-related concepts. Cybernetics "has its own foundations" (Ross Ashby, 1956). With this conception it is now possible for someone to be "a cybernetician." Cybernetics becomes a "window on the world." Wherever he looks, the cybernetician sees the ubiquitous phenomena of control and communication, learning and adaptation, self-organization and evolution. The power of cybernetics as a transdiscipline (Latin "trans" - across) is that it abstracts, from the many domains it adumbrates, models of great generality. A simple but powerful formulation of the essence of cybernetics is that its key concepts are "process" and "product" and that its main methodology is to model the *form* of processes and their products, abstracted from any particular embodiment. Such models serve several purposes: they bring order to the complex relations between disciplines; they provide useful tools for ordering the complexity within disciplines; as above, they provide a "lingua franca" for inter-disciplinary communication; they may also serve as powerful pedagogic and cultural tools for the transmission of key insights and understandings to succeeding generations. If a transdisciplinary approach is to make a real contribution in the natural and social sciences, it must be more than a list of similitudes. It must also be epistemologically sophisticated and well-grounded. Cybernetics, with its explicit distinction between first and second order forms, can claim to satisfy these criteria.

3. By metadisciplinarity we mean cybernetics is a "discipline about disciplines" (Greek "meta", above). It comments on the forms and procedures that constitute particular disciplines. It comments on the disciplinary activities of modelling, controlling and

predicting. Science, pure and applied, is a cybernetic pursuit and art "L'art d'assurerer l'efficacité de l'action" (Couffignal, 1960). The metadisciplinary aspect of cybernetic thought was explicit in its founding. It reached full fruition with von Foerster's (op. cit.) articulation of the fully reflexive metadisciplinary activity where cybernetics is used to study its own workings: second order cybernetics, also referred to as the cybernetics cybernetics.

3. Second order cybernetics, sociocybernetics and the social sciences

First and second order cybernetics are the study of "observed systems" and the study of "observing systems", respectively. First order study is of "observed systems", where we may deploy the research paradigms of the natural sciences and seek falsification of hypotheses. However, all this should take place under the rubric of the second order study of "observing systems." First order systems are defined from the perspectives of our second order concerns and understandings. Von Foerster (op. cit.) has gone on to discuss epistemological limits and ethical implications of second-order understandings: "We think, therefore we are"; "To know is to be." He invites the observer of systems to "enter the domain of his own descriptions" and accept responsibility for being in the world, thus echoing the longstanding discussions in sociology about the "reflexive" nature of the "social". Gordon Pask made second-order concerns explicit by developing a cybernetic "theory of conversations", with particular applications in education and epistemology (Pask, 1975).

Sociocybernetics is a more recently adopted term that refers to the application of cybernetics and the systems sciences to the social sciences. Sociocybernetics is developing the coherence of a "research programme", in the sense of Lakatos (1970). (Geyer, 1995; Hornung, this conference). We may usefully distinguish four approaches to the study of social systems:
- studies of social systems and social behaviour that adopt classical scientific modes of investigation;
- studies that investigate the interactions of social actors;
- approaches that attempt to characterize social systems as distinct forms of autonomous whole;
- approaches that use judicious mixes of the above.

First order approaches to the study of social systems and social behaviour are those that adopt classical scientific modes of investigation. From the perspective of an external observer, a domain of observation is distinguished and modelled as set of variables, which together constitute a multi-dimensional universe of discourse or reference frame. Particular systems are modelled as relations (products) and their transformations (processes). Values of variables are measured. Hypotheses are abduced about constraints or "lawfulness" within the domain of observation and serve as the basis as for the generation of testable predictions. The roots of this approach can be found in the empirical sociological studies of Emile Durkheim.

Second order approaches are those that that investigate the interactions of social actors. What is of interest is not just the behaviour of the actors but, critically, the systems of belief that give "meaning" to their behaviours, including the beliefs they hold about each others' beliefs. The observer can no longer give himself the privilege of being an "external observer" except by setting up elaborate contracts with participants (as in experimental psychology). He may form hypotheses about participants' beliefs on the basis of observations of behaviour but may also give himself access to those beliefs by eavesdropping on or participating in conversational exchanges. The roots of this approach are many, including Max Weber's

emphasis on the importance of *verstehen*, Alfred Schutz's phenomenology of the social world and the 'social behaviourism' of G. H. Mead.

Some approaches to the study of social systems are predicated on the idea that social systems are distinct forms of autonomous whole. Early expressions of the idea of society as a 'functioning' whole that may be analysed into participating structures and processes are to be found in the writings of Karl Marx, Emile Durkheim and, later, in the theories of Talcott Parsons. Cybernetics and systems theory have provided more recent formulations (see, e.g., Luhmann, 1995).

Mixed approaches include methodological mixing, now a common practice in the social sciences as mixes of quantitative and qualitative methodologies. Ahlemeyer (1997) is an example which draws directly on the first and second order distinction. Other mixed approaches are theoretical, as in, for example, the use of theories of actor interaction to account for systemic properties of organisations (see Scott, 2005, for an example).

Reflexively, sociocybernetics contributes to the development of second order cybernetics. The cybernetics of cybernetics becomes the sociocybernetics of sociocybernetics. As evidenced by the RC51 Conferences on Sociocybernetics, there are now rich dialogues between cyberneticians, systems scientists and social scientists, that, as evidenced by their continued participation, is experienced by the participants as being mutually beneficial and enlightening. (See http://www.unizar.es/sociocybernetics/).

5. Epistemological case study: What is a symbol?

Our chosen central question "What is a symbol?" has a famous antecedent in Warren McCulloch's (1961) enquiry, "What is a number that a man may know it, and a man, that he may know a number?" McCulloch and other early cyberneticians (von Foerster, Ross Ashby, Pask) had a rich view of 'computation', encompassing artificial and natural systems of many kinds. Although McCulloch himself, with the aid of Walter Pitts, demonstrated that a brain could function as a data processing device of great power (a Turing machine), he was well aware that 'biological computation' was a more complex and mysterious affair (see, e.g., his contributions to discussions in Yovits and Cameron (eds, 1960).

However, others thought differently, and with the rise of 'artificial intelligence' (AI) approaches as the dominant paradigm in cognitive science, the 'physical symbol-system' hypothesis of Newell and Simon (1976, p. 41) became widely and, we submit, unthinkingly accepted. The hypothesis states that: "A physical-symbol system has the necessary and sufficient means for general intelligent action." Elsewhere they note that both brains and computers are physical-symbol systems. With one stroke they reduced the complexity and mystery of animal and human awareness and consciousness to the simplicity of data processing devices.

It is our contention that the 'symbolic' (and, indeed, the 'sub-symbolic', connectionist) approaches of artificial intelligence and cognitive science were misconceived and have therefore inevitably stalled. Tragically, a good deal of the post-war progress that was made with such questions through first and second order cybernetics and its sister disciplines (Heims, 1993; Conway and Siegelman, 2004) was lost because of the 'triumph' of the dominant AI/cognitive science paradigm (Gardner, 1987). Although this paradigm dominated post-war discourse, it was not without its critics. John Searle, for example, was an ever present thorn to the computational orthodoxy via his Chinese Room argument (Searle, 1980).

Joseph Margolis (1989) tirelessly tried to reconcile science and narrative by contrasting naïve 'computationalism' with the rich hermeneutic tradition. As time passed, the question was too troublesome to be ignored and by 1991 even Hilary Putnam, one of the founding architects of 'symbolic computationalism' (Putnam, 1979), came to publicly doubt that computationalism could represent reality (Putnam, 1991). In the early 1990s, questions about how to 'ground' symbols – to give them 'meaning' - in anything other than an infinite regress re-emerged in the guise of the 'symbol grounding problem' (Harnad, 1990), with recommendations to ground symbols in newly fashionable connectionist computational architectures. However, the formulation of the issues remained philosophically naïve. Arguments from cybernetics based on concepts of self-organisation and organisational closure, began to be re-introduced to the cognitive science literature as radical departures from orthodoxy (Shurville, 1993, forthcoming). Peter Cariani (1990) re-introduced cybernetics based concepts, such as Pask's accounts of the evolution of sensory systems (Pask, 1959; c.f. Bird et al, 2003), that indicated how complex systems could evolve with their own intrinsic mechanisms for 'meaning' construction (nowadays referred to as 'biosemiotics') and 'meaning sharing' via the the use of 'significant symbols' (Mead, 1934; see also below).

We believe that in this new century there is not only a vacuum of theory within the mainstream of cognitive science—which, as part of its research programme aims to provide epistemological foundations for the philosophy of science—but that disciplines derived from cybernetics and its siblings stand ready once more to make significant contributions. The work may only be beginning but, as it becomes ever harder to 'fix' symbolic computationalism (c.f., Scheutz, 2002), we believe it is underway. Here, in brief, we attempt our own answer to the question, "What is a symbol?"

6. What is a symbol?: a solution outlined

Ashby (1956) writes: "Cybernetics might in fact be defined as the study of systems that are open to energy but closed to information and control - systems that are 'information tight'." (Ashby, 1956). Von Foerster, Pask, Maturana and Luhmann have all been particularly alive to the epistemological consequences of this 'organisational closure'. In brief, an organism does not receive 'information' as data transmitted to it. Rather, as a circularly organised system it interprets perturbations as being informative. It is important to note that this use of the term 'information' is clearly different from the usage in computer science ('information processing' meaning, strictly, data processing, the transmission of data and the transformation of one data "pattern" into another) or by Shannon and Weaver (a measure of the surprise value of a "message") or Stonier and others (a measure of the extent to which a system is 'ordered'). The use of the term by Ashby is essentially the same as that of Bateson in his aphorism "Information is a difference that makes a difference " and that of Korzinski, ("Information cannot be separated from its utilisation") and that of von Foerster ("The environment contains no information; it is as it is". At this point it is useful to distinguish between 'information', 'communication', 'signification' and 'language'/'langauging'.

Information, in Bateson's (1972) terse aphorism, is "a difference that makes a difference" and refers to the role that certain physically distinct events have, within the circular organisation that is the organism, of controlling or regulating other events (processes). These events, which, following Cherry (1957), we shall refer to as 'signals', may originate within or without the organism. Communication refers to the exchange of signals between organisms or between parts of an organism that synchronises their behaviour, that for the moment at least, constitutes them as subsystems within a larger system. Signification refers to the fact that, at least from the perspective of an external observer, a signal stands for or represents a relation

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or state of affairs other than itself. Where there is a relatively invariant correlation between signals and their referents, one may talk of a sign system (Cherry, op. cit.).

Different authors employ different terminology. Ogden and Richards (1923) refer to 'symbols'. Piaget (1972) refers generally to a 'semiotic function'. Mead (1934) develops the concept of the 'significant symbol'. Cherry (following Pierce, 1972) considers 'sign' to be the preferred term for events and classes of event that signify or stand for other events, entities or relations. He quotes from the Oxford English Dictionary: "A symbol is a sign regarded by general consent as naturally typifying or representing or recalling something by possession of analogous qualities or by association in fact or thought." 'Uncle Sam' is given as an example of a symbol. The term 'icon' is also used for 'a sign which is considered to bear some analogy or resemble to the form of its designation" (Cherry, op.cit.). Thus, both symbols and icons are signs and some symbols are iconic but signs in general are not necessarily symbols or icons. Although all communications involves signals, not all employ a distinguishable sign system. In an example due to Tinbergen (1951), the struggling fly signals its presence to the spider but the fly's response is not a sign in the sense intended. Signs (Tinbergen's term is 'sign stimuli) and sign systems evolve as 'responses that are adaptive in interaction with other organisms'.

Human sign systems form part of what are generally referred to as 'human languages'. (Without elaborating further here, we submit that other uses of the term language as in 'computer language', 'language of the bees' are metaphorical.) "Languages are forms of life", says Wittgenstein (1953) and in doing so both stresses the richness and complexity of the forms and functions of language and reminds us that to explain language is to explain life itself. Elsewhere, he says, "Do not ask what a word means; look to see how it is used". Thus, if the question "What is language?" is asked in the form, "What do we mean by "language ?", we are damned from the start. Let us instead ask, "How is the word 'language' used?". Greene (1975), following Vygotsky (1962) and Luria (1961), suggests that 'language', as a label, refers to a medium or vehicle that serves two distinct but interrelated functions: (i) communication between persons and (ii) representing and directing 'one's own, internal cognitive processes'. For our purposes, we find it useful to distinguish Greene's second function as having two components: the representational function and the attention-directing function. (Von Foerster (op. cit.) refers to these as the 'describing' and 'coordinating functions').

'Universal grammar' – that which is common to all "languages" when viewed, a la Chomsky, in the abstract, as syntactic and lexical systems - requires a logical syntax with negation. In Piaget's (1972) classic account, this logic is imminent in the logic of action and the concept of reversibility (actions may be 'undone'). Integration of sensori-motor schemata into coordinated wholes both generates 'object permanence' and a differentiation of subject from object. The organism may act on its own actions. There is an accompanying 'awareness of awareness'; insofar as the organism's actions are part of a coordinated, co-adapted whole, there is awareness of self (c.f. Kagan, 1979, p.293), though, as yet, no stable 'self-image' or 'self-consciousness'.

As there is a 'sensori-motor or 'enactive' logic of action, so there is a tacit logic of interaction. An organism's adaptations coordinate sensory and motor activity. In the 'dance' of social activity, these coordinations become coordinated. Piaget (1956) says of the former: "Without a mathematical or logical apparatus, there is no direct 'reading of facts', because this is a prerequisite. Such an apparatus is derived from experience, the abstraction being taken from the action performed upon the object and not from the object itself". This is

essentially what Mead says of social interaction: its logic arises as an abstraction from the experience of interaction.

Mead's (1934) key concept is that of the 'significant symbol'. A better label, perhaps, is 'the social sign'. It's significance lies in the fact that communication employing such a sign system is between participants who can 'take the perspective of the other'. Such signs not only have an agreed or shared meaning, in the sense that an external observer notes that they are used in similar ways by the participants, they also have agreed or shared meanings from the perspective of the participants. In brief, the participants, too, are observers. The 'I' emerges in the dialectic of reciprocal role taking: taking the other's perspective. The 'generalised other' is internalised. Thought becomes an inner dialogue between perspectives: the self is a social process. 'Self-image' is a social construct and may take different forms in different cultures.

In Maturana's account language arises as behaviours ('languaging) that coordinate 'coordinations of coordinations' (Maturana and Varela, 1980, Maturana, 1987). Through mutual coordinations, organisms may come to compute themselves and others as 'selves', giving rise to the 'I/Thou' relationship. That is, by becoming observers of 'others', we 'transcend into the domain of self-observation' where, "I am the observed relation between myself and observing myself." (von Foerster, op. cit.). For von Foerster, an 'object' is a token for the 'eigen values' of 'eigen- behaviours', the invariants of experience; the observer is her own ultimate object.

Thus, for Maturana, consciousness (knowing with) is experienced by participants in 'languaging'. "Languaging takes place as recursive consensual coordinations of consensual coordinations of behaviour... There is a recursion whenever ... the re-application of an operation occurs on the consequences of its previous application ... Any level of recursion may recursively become a domain of objects that operates as a ground level for further recursions." "Objects arise in language in the first recursion of consensual coordinations of consensual coordinations of behaviour . ... Observing arises as an operation in a second recursion that distinguishes a distinction ... The observer appears in a third order recursion that distinguishes distinguishing..... Self-consciousness (self-awareness) arises in a fourth order recursion in which observing the observer takes place." "The self arises as an experience in the experience of self-consciousness .. self-consciousness and self take place in the dynamic relations of languaging .."

To sum up what we have learned from Piaget, Mead, von Foerster, Maturana and others, our vision is of two organisationally closed systems synchronised in interaction, where each is being 'in-formed' of the other and where both are 'computing' the same 'object' and are 'computing' that they both 'know' that is what is happening. They may both then 'compute' a second 'object' such that they both 'know' the second 'object' stands for or 'represents' the first 'object', i.e., the second 'object' is a Meadian 'significant symbol'.

6. Concluding comments

Our epistemological case history provides a sociocybernetic transdisciplinary analysis of issues common to many scientific domains with, we hope clarity and unifying usefulness. As noted earlier, Couffignal (1960) suggests that cybernetics may be considered to be an art, "L'art d'assurer l'efficacite de l'action." This suggests a useful perspective to adopt in order to gain sociocybernetic, transdisciplinary unifying insight into the nature of the arts, humanities and vocational disciplines.

Quite straightforwardly, cybernetics is the art of designing and bringing about desirable artifacts and futures but there are implications too for what it means to act in the role of artist qua designer. In his discussions of ethics and second order cybernetics, von Foerster points out that adopting a radical constructivist epistemology carries with it the corollary that one is responsible for the world one has constructed and that this may serve as a basis for an ethical approach to being in the world. Both quantum physics and forensic science tell us that "Every contact leaves a trace." Between social actors every contact has the form of an agreement, a contract, including the agreement to disagree. Here we can say, "Every contract leaves a trace" (Scott, 1999). Works of art – and here we include the discourses of scholars in the humanities - may provoke awareness, inform and enlighten, bring about the good. They may also corrupt and confuse and limit the good. Gordon Pask (1990) advises that we may strive for "unity without uniformity". Evil is that which curtails the opportunities for actors to interact.

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