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The **JOURNAL OF SOCIOCYBERNETICS** (ISSN 1607-8667) is a peer reviewed, electronic journal published biannually--Spring/Summer and Fall/Winter--by the Research Committee on Sociocybernetics of the International Sociological Association.

MANUSCRIPT submissions should be sent electronically (in MSWord or Rich Text File format) to each of the editors: Richard E. Lee rlee@binghamton.edu, Felix Geyer, geyer@xs4all.nl, and Cor van Dijkum, c.vandijkum@fss.uu.nl. In general, please follow the Chicago Manuel of Style; citations and bibliography should follow the current journal style (APA). Normally, articles should be original texts of no more than 6000 words, although longer articles will be considered in exceptional circumstances. The Journal looks for submissions that are innovative and apply principles of General Systems Theory and Cybernetics to the social sciences, broadly conceived.

SOCIOCYBERNETICS traces its intellectual roots to the rise of a panoply of new approaches to scientific inquiry beginning in the 1940's. These included General System Theory, cybernetics and information theory, game theory and automata, net, set, graph and compartment theories, and decision and queuing theory conceived as strategies in one way or another appropriate to the study of organized complexity. Although today the Research Committee casts a wide net in terms of appropriate subject matters, pertinent theoretical frameworks and applicable methodologies, the range of approaches deployed by scholars associated with RC51 reflect the maturation of these developments. Here we find, again, GST and first- and second-order cybernetics; in addition, there is widespread sensitivity to the issues raised by "complexity studies," especially in work conceptualizing systems as self-organizing, autocatalytic or autopoietic. "System theory", in the form given it by Niklas Luhmann, and world-systems analysis are also prominently represented within the ranks of RC51.

The institutionalization of sociocybernetic approaches in what was to become RC51, the Research Committee on Sociocybernetics of the International Sociological Association, began in 1980 with the founding of an ISA Ad Hoc Group and proceeded with the organization of sessions at succeeding quadrennial World Congresses of Sociology. The eventual RC51 became a Thematic Group and then a Working Group. Finally, in recognition of its extraordinary success (growing from some 30 members in early 1995 to 240 in 1998), the group was promoted to the status of Research Committee at the 1998 World Congress of Sociology in Montreal.

Over these past two decades, sociocybernetics has attracted a broad range of scholars whose departmental affiliations represent the entire spectrum of the disciplines, from the humanities and the social sciences through the sciences, mathematics and engineering. Furthermore, the many countries of origin of these RC51 members attest to the wide international appeal of sociocybernetic approaches. Within this highly diverse community, there is wide agreement on some very general issues, for instance, on developing strategies for the study of human reality that avoid reification, are cognizant of the pitfalls of reductionism and dualism, and generally eschew linear or homeostatic models. Not surprisingly, however, there are also wide divergences in subject matter, theoretical frameworks and methodological practices.

Many have argued that models developed for the study of complexity can be usefully appropriated for the study of human reality. Moreover, however, the emphasis in complexity studies on contingency, context-dependency, multiple, overlapping temporal and spatial frameworks, and deterministic but unpredictable systems displaying an arrow-of-time suggest that the dividing line between the sciences and the historical social sciences is fuzzier than many might like to think. What is more, in the humanities, the uniquely modern concepts of original object and autonomous human creator have come under serious attack. The coincidence of these two phenomena substantiate the impression that across the disciplines there may be observed a new concern for spatial-temporal wholes constituted at once of relational structures and the phenomenological time of their reproduction and change.

In this context of rich history and exciting possibilities, the Research Committee on Sociocybernetics of the International Sociological Association extends an open invitation through the **Journal of Sociocybernetics** to all engaged in the common quest to explain and understand social reality holistically and self-reflexively without forsaking a concern for human values--human values not construed simply as a matter of individual ethics, but conceived as an integral part of a social science for our time.

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Articles

MAKING THE SOCIAL SUBJECT: THE ROLE OF THEORY AND TECHNOLOGY IN SOCIAL EMERGENCE

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IT IS NOT POSSIBLE to understand our culture, our science, or our everyday life without the idea of *machine*. We are unable to understand ourselves without engaging the machine in this explanation, probably in the same way a XII century farmer was unable to explain himself without referring to the idea of God. Here we are not indicating merely an instrumental level (i.e., the relevance of machines in our culture), but rather a heuristic one (i.e., machine as a major world-explaining device). But while Lewis Mumford refers to the Myth of the Machine as the founding myth of Western civilization, we shall suggest the use of "metaphor" and "culture" in the place of "myth" and "civilization".

This *metaphor of the machine* engages four main issues: the *subject* (source of decision and action), the *object* (the world to be explained, modeled or operated in), the *product* (meeting point between object and subject or world/agent), and the *producer* (as a result of subject's transformation addressed to the axis object/product). We can conceive the metaphor of the machine as a machine itself, insofar as it produces coherent images of the world; consequently, it opens world and subject to a sort of "fuzzy modeling". Broadly speaking, the idea of the machine operates heuristic transformations in the field marked by the points cited: subject, object, product and producer. In a more concrete way, a machine is the fixed point of any possible trajectory between subject, object, product and producer. The very use of technology as a heuristic practice lies precisely in this specific recursiveness between the term "machine" and its meaning sources.

A MYTHOLOGY OF THE MACHINE

The idea of the machine emerges at the crossroads of two crucial semantic fields, *ars-techné* and *poiesis-inventio*. It is usual to place the early use of machine as a model in

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Presocratic thought (Farrington 1974). Mumford's mythology of the machine points precisely to this: the presence of cultural artifacts and everyday-life tools was easily transferred by analogy to explain natural phenomena. However, this perspective forgets that tools must have some heuristic value before they can play their role in analogy. Only if the tool makes clear a context (i.e., operationally coherent through causal relation) can it be used as a "heuristic tool". For example, only if the air pump works as a causal principle related to the sense "air as an object/product", can it play a heuristic role in explaining the function of the lung. In other words, there is a transference of heuristic properties before (and not instead of) a construction of them by analogy. There is, however, a semantic feedback in such use of analogy. The product of interpretation (e.g. the function of the lung) becomes a heuristic reference (sense-producer) for the referent's interpretation (e.g. air pump). This is especially evident in the use of brain/computer metaphors in the emergence and development of the cognitive sciences.

Metaphor implies a process through which meanings and attributes are reorganized. It works as a global semantic organizer. Myth, on the other hand, can be interpreted as a narration structured as metaphor (a metaphoric narration). Theory, as we shall argue later, can also be understood as a system of metaphors, particularly if we take into account proximity between model and metaphor. The difference between myth and theory lies not only in the presence or absence of a narrative structure, but more specifically in the direction of the causal trajectory; while myth imposes its causal structure on phenomena, theory "negotiates" causal links. Myth lacks semantic feedback, while metaphor produces it. One more epistemological point: both metaphor and theory are semantically coherent with the idea of *phenomenon*, as differentiated from *fact*. *Phenomenon* includes subject/object/product/producer, while fact simply includes object/product (and, eventually, producer).

The Latin *machina* inherited the early ambiguity of *ars-techné* and *poiesis-inventio* that allows the term to cross the frontiers of the object (physical mechanism). *Machina* then denotes a causal relation of elements organized to fulfill a function. On the basis of this ambiguity, the idea of the machine becomes, over the centuries, a sort of *ontoteleological* device. The metaphor of the machine combines its ontological status (a machine is something that *is*) with its teleological organization (a machine is something that *is for*).

Up to the seventeenth century, the idea of the machine belonged more to the attributes of mind than to the attributes of matter. The notion of deductive logic as a mechanical procedure is deeply related to this point. We can, then, perceive continuities among Copernicus, Descartes, Newton, Laplace or La Mettrie: a machine being a deductively organized *perpetuum mobile* with an externally induced finality. During this period, explaining the world in terms of a machine became a search for the perfect clock. The implications of this search are still present: a machine is a function, i.e., a relation among figures (symbols, quantities, numbers...).

The eighteenth and nineteenth centuries introduced a global change in the use of the idea of the machine: the triumph of inductive logic, the instrumental revolution and the coupling of technology, science and production structures in the context of a new socioeconomic regime turned the clock into a factory. "Machine" became a physical device producing objects (products), but also a product itself of a mechanical view of science and technology as a world-transforming mechanism. This point represents a first step in bringing

together machine and the idea of social subject, in so far as it opens up a recursive loop between product and producer. It is precisely this recursive loop that allows the long tradition of *organism*, from Aristotle to Darwinism, to be integrated into the idea of machine. However, the main consequence of such a process is to reconcile both machine and product in a context of an increasing 'economization' of social structures (see Dupuy 1998).

The course of science and technology throughout the twentieth century underlines the meeting of the two principal heuristic traditions in Western thought, organism and machine. In a broad perspective, the first, organism, comprises what was to be formulated as self-organizing properties (*causa sui*), order out of noise (*ordo ex chao*) and self-reproducing properties. The latter, machine, comprises the overlap of deductive logics and instrumental finalism. The difference between these two heuristic traditions may also be understood as a difference in the ontological dependence between product and producer. Obviously, the increasing epistemological relevance of modeling has much to do with the semantic crossbreeding of organism and machine. Computationalism is the language in which this crossbreeding is expressed. The eruption of complexity at the epistemic heart of Western science led to a unification of its heuristic properties under the concept of system.

We have now witnessed the marriage of technology and science, and the marriage of organism and machine. From this point on, the object of inquiry of techno-science will not be the machine of Nature, but the nature of the Machine.

The main epistemological implication is the extension of the machine to the universe of thought on a level never reached before. A model is a kind of systematic metaphor. If we can understand metaphor as a semantic machine, then a model is to be described as a syntactic machine. Besides, the idea of model introduces a specific ambiguity (the model is what imitates and what should be imitated) that seems to be a correlate of the already mentioned semantic feedback in the case of metaphor. Edgar Morin (1973) defines a machine as a *praxical being*, i.e., any order-producing organization. Thus, an organic model traditionally refers to endogenous order, while a mechanical model points to exogenous order. However, from the very moment complexity bursts into science and technology, endogenous order becomes an attribute of complex machines, far from the classic opposites of physical/logical and organism/machine. This seems also to be the epistemological background of von Foerster's distinction, trivial machines vs. non-trivial machines.

While metaphor and model introduce organization as an attribute of meaning, it is not possible to conceive the idea of machine without reference to the observer. The relevance of observer to the emergence of system may be pointed out here. However, the use of "machine" poses a specific epistemic role of subject as producer, and thus, observation (attribution of meaning) becomes a kind of *production*. This point leads us to consider order not as a proposition about the world, but more specifically as a proposition about a perception/interpretation of the world. Consequently, the idea of order becomes autological.

In such a context, the use of machine as an order-producing device acquires deep epistemic connotations in the social sciences, where observation and modeling are subjected to the specific interaction of the observer and the observed. Moreover, the extension to the epistemological level of model and metaphor as machines leads to a reformulation of theory, technology and cognition in reference to the traditional trilogy subject/society/language.

THE QUEST FOR SUBJECTS AND OBJECTS

The split of subject and object is the source of an old epistemological discussion whose consequences are especially relevant to the social sciences. Our position in this debate can be formulated as a cognitive indetermination principle: in an epistemological and ontological sense, to determine subject or object implies the indetermination of cognition, for subject and object are specific positions of a circular process named cognition. To this extent, both subject and object are to be understood as products of cognitive process and, simultaneously, producers of it. The idea of machine comprises both subject/object and product/producer, and this is precisely the reason why it can be placed at a higher epistemic level, particularly in what concerns the social sciences.

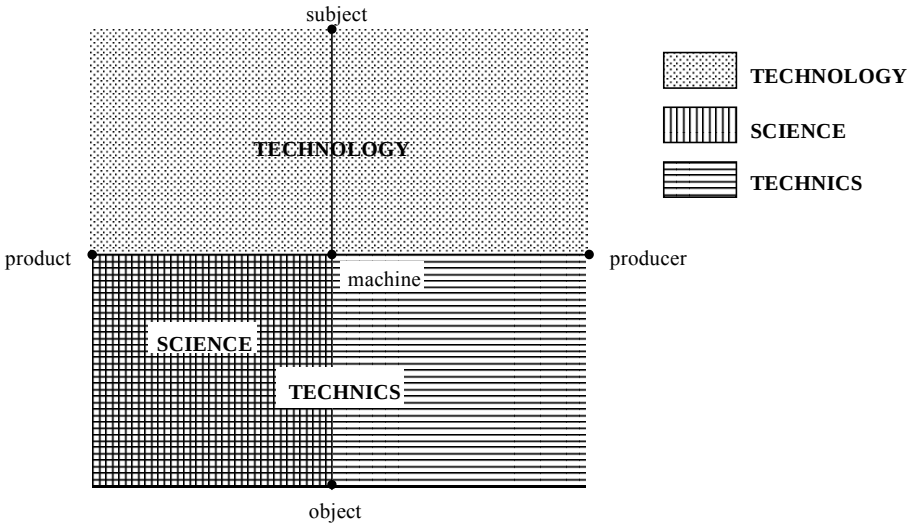
The discussion about the subject/object split has generated two epistemological pursuits. In the sociological tradition, a peculiar proximity between the operational implications of subject and machine can be observed. The first is usually presented as a narrative continuity (Varela 1996; Dennett 1987), as an n^{th}-order recursive operator (von Foerster 1991), as an origin (Derrida 1997) as an endogenous fixed point (Dupuy 1998), or an intentional attractor (Aguado 1998). The latter is usually presented as a functional regularity that relates to its environment in terms of "conduct". In all of these cases, machine and subject are devices that produce order as operational coherence. Here we should remember that the classic machine (mechanism) emerges as a pseudo-subject in the semantic sphere of product/producer, the product being in its turn a mediator for subject and object in cognitive and instrumental terms. Simultaneously, the kind of operational coherence they produce is the kind of operational coherence from which they emerge and in which they may be described: social order. The recursive process relating subjects to objects through the mediation of product/producer dynamics we shall call *sociogenesis*. According to this concept, it is the idea of machine that constitutes the interpretations of subjects and, consequently, becomes the main endogenous fixed point of the sociogenetic process.

We have pointed out above some of the main directions concerning subject and machine, in which the idea of machine has played an important role for both the modern and postmodern tradition. The concern for object and machine has been traditionally related to the debate over the epistemology of the social sciences. On this point, we shall assume the position of an epistemological constructivism, which in the case of the social sciences presents some peculiarities. Phenomenological precautions about the ontological independence of the concept of “object” led to its substitution by the concept of “phenomenon” as the main epistemological consequence. The social sciences could not remain unconcerned regarding this issue; a social object is a social construct, a *product*. From this point of view, the heuristic relevance of the machine enters society in a double way: from the outside, through the epistemological revision opened up by phenomenology; and from the inside, by the epistemological consequences of the sociology of science and technology. Scientific knowledge, hence, is to be understood as a kind of public knowledge that produces a type of social order (operational coherence) we may call *epistemic*. Thus, theory may be described as a system of metaphors and models in the sense they were posed previously.

The location of traditional discussions about the subject/object split in a context of

product/producer mediation leads our argument to examine an issue whose increasing relevance in social life calls for a theoretical and epistemological revision: the construal of technology as the field in which the borders between subject and object are drawn.

We have outlined the epistemological terrain of social processes (including the social sciences) according to the poles of subject, object, product and producer, all of them organized upon a fixed point (machine). This will allow us to map a conceptual arena in which science, technics, and technology define their domains in terms of semantic fields. It is important to underline that "machine" operates as a fixed point not only by organizing all the possible semantic relations among the mentioned poles, but moreover because we cannot conceive a machine without referring to any of them (subject, object, product or producer). Nevertheless, there is no machine in a pure sense. If we can envision any of the possible trajectories within the outlined space as a recursive function, machine then prefigures a homology of its eigenvalue.



According to the figure, we shall propose the following mediations for the use of "machine":

(a) Machine as a mediator between subject and producer: It marks the boundary where the technological subject (and hence, the social subject) emerges.

(b) Machine as a mediator between subject and product: It marks the boundary that defines the technological dimensions of the machine as an order-producing device.

(c) Machine as a mediator between product and object: It marks the boundary of the technical object in the specific sense pointed to by the classic idea of the machine as a mechanism.

(d) Machine as a mediator between producer and object: It marks the boundary of technical action in its original sense--the idea of the machine as a complex tool, as it was conceived in the mediaeval handicraft tradition and as the predecessor of the 17th century instrumental revolution.

(e) Machine as a mediator between product and producer: It marks the boundary where

the technical subject emerges as a focus of instrumental intentionality (*homo faber*).

(f) Machine as a mediator between subject and object: Understanding object-machine as related to product and subject-machine as related to producer, the idea of the machine operates here as a projection of subject upon object and vice versa, a projection of object upon subject. Subject-producer reproduces object-product's order through technics. Object-product reproduces subject-producer's order through technology.

The trajectory outlined in (c) organizes possible links among object, machine and product. It constitutes the semantic field of science (see figure), in which subject is exiled to the field of philosophy, and producer is exiled to the field of economy and aesthetics. The semantic field of technics (see figure) includes the technical subject (*homofaber*) as a reference point on the axis product/producer as it is posed in trajectories (c) and (d), where relations among object, machine and product are configured. The field marked by trajectories (a) and (b), among subject, machine, product and producer, indicates the area of semantic relevance for technology. It includes the technological subject (subject-producer) and excludes the idea of an ontologically self-sufficient object that distinguishes scientific objectivism. Consequently, the technological object (social object) can only be conceived as referring to a subject in a production relation.

TOWARDS A COMPLEX CONCEPT OF TECHNOLOGY

Following these reflections on the role of the machine in the constitution of social subjects within the context of the Western sociological tradition, we have come to the point where a revision of the idea of technology is necessary. To do this, we shall begin with a short reference to the evolution of this idea in social theory.

The crucial importance of machines and mechanisms in our everyday life has led to a common use of technology as the knowledge about production and use of technical objects. In a similar, but perhaps more refined, sense Sfez (1988) considers technology as the social discourse (*logos*) about technics. Here, technology becomes a theory of the use and constitution of the machine (basically, an instrumental machine), that is, the systematic reflection about object-producing devices. This constrains technology to the context of the effective production of functionally determined correlations, what in other words means posing technology as a teleological operator.

This explicit finalist feature is what accounts for the early exclusion of technology from "science". This exclusion disappeared during the 17th century instrumental revolution, and, subsequently, technology burst into science and social life together with a crucial idea, halfway between organism and machine: the idea of progress. This was the point where a philosophy of technology emerged on the basis of systematic theoretical works (in a general way, Bacon, and more particularly, in such recent work as Desauer 1927, Mumford 1934 and 1967-70, Ellul 1960, and Kapp 1977), but also on the basis of sporadic considerations of social thinkers and philosophers (again, in a general way, Kant and Marx, and more particularly, in such recent work as Heidegger 1984, Habermas 1994, and Ortega 1996). Especially in the latter case, we can observe an inclination to "de-objectivize" technology, that is, to consider object-production

processes in terms of subjective action.

Thus, while Bacon conceives technology as relieving the human condition through technics, Dessauer will consider the creative act as its main feature. Heidegger, in his turn, considers technology as a genre of truth epitomized by its tendency to unveil. In such terms, technology shows up as a kind knowledge. Ortega stresses the transformative implications of technical acts not precisely in reference to the object (as traditionally considered from Bacon on), but to the subject: it is the subject who is transformed by technological acts and, consequently, thought takes part as a technological act.

The Marxist tradition--and particularly Marcuse--centers its efforts on a search for the technological object, taking the technological subject as given by productive relations. Technology here appears as a concealment of social object (value). Despite its explicit critique of the social and ideological implications of technology, the marxist tradition cannot hide an instrumental overvaluation of technics. In the case of most ideologically mediated methodologies, it is not difficult to observe a sort of social engineering that operates on society as a trivial machine.

From all these perspectives, technology presupposes technics as significant human action. Here, technics are understood as any systematic human action addressed to the organization and adaptative transformation of the environment, i.e., the introduction of subjective order in natural order. Thus, technology denotes a second order operational coherence or, in other words, the organization of subjective order. And furthermore, technology refers to technical objects (such as classic machines), but also--as a result of the epistemological extension of product--to social and cultural objects/processes, such as institutions, knowledge, identities, meanings, and more. This point marks technology's qualitative turn from object to subject.

Foucault's concept of technology adresses its attention to the idea of social subject as a product. The genealogy of subject as a socio-historic search starts precisely from this premise. Foucault takes and develops a Habermasian catalogue of technologies:

(a) Technologies of production: "those that ensure production, transformation and handle things" (Foucault 1986: 48).

(b) Technologies of meaning: those that allow the use of signs and symbols in relation to sense and meanings.

(c) Technologies of power: those that "determine the conduct of individuals, subject them to some kind of finality and imply a subject's objectivation" (Foucault 1986: 48).

(d) Technologies of the self: those operations through which the subject or individual constitutes or transforms him/herself.

Technologies of production, according to Foucault, correspond to what we have called technics.Technologies of power condense the marxist critical tradition of technology as a superstructure. In the case of technologies of meaning, and more specifically technologies of the subject, both meaning and subject are no longer presented as given origins for technological action, but as its targets. Consequently, technological action corresponds to cognitive action; subject and object meet in the idea of product. Production, simultaneously, moves far from its 19th century instrumental connotation to approach Aristotelian *poiesis*.

In sum, we may conclude that technics produce objects, while technology produces

subjects. Thus, we have arrived at a double meaning for technology. On the one hand, it is a knowledge of machines (*logos* over *techne*). On the other hand, it is a machine of knowledge (*techne* over *logos*).

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MODELING THE GLOBAL INTERNATIONAL SYSTEM: LOGICAL CONSISTENCY WITH THEORY, INTERNAL SELF-CONSISTENCY, AND EMPIRICAL FALSIFIABILITY

Michael P. Byron*

THIS RESEARCH evaluates the inter-relationships between theory, model, and reality. The assessment is carried out in discrete stages. To initiate this inquiry I here and now present a statement of the general problem underlying this paper: How can we "know" if the results of a theory-derived computer simulation, particularly my evolutionary learning simulation, offer meaningful insights into the aspects of phenomenological reality being modeled? How can we "know" if the theories involved offer greater explanatory utility than other theoretical approaches, such as, in particular, rational choice modeling?

To resolve this question I discuss the nature of theory in the context of the philosophy of science. "Good" theories are those that offer the greatest potential for empirical corroboration or refutation, (i.e. "falsifiability") while simultaneously possessing the greatest descriptive and predictive breadth and depth with respect to phenomenological reality. I find that my theory of crisis-driven evolutionary learning fares well with respect to these several criteria. Pursuant to this, I evaluate my crisis-driven evolutionary learning theory in the context of its assumption of systemic learning and its operationalization in a BASIC language computer simulation. What correspondences exist between theory and model? Do these correspondences also exist for rational choice modeling?

To investigate these questions, the issue of the correspondence between model simulation-derived indicators and empirical indicators of phenomenological reality for both evolutionary learning and rational choice premised theories is addressed from the perspective of a philosophy of science derived analytical framework. Even assuming that the simulation-derived indicators are reliable and valid and that they accurately reflect theory, to what extent can model indicators correspond to real-world empirical indicators? That is, can simulation in general, and my crisis-driven evolutionary theory simulation in particular, as opposed to its rational choice modeling alternative, provide meaningful information concerning corresponding real-world phenomena as "captured" by empirical measures? I find that these questions are not insurmountable, although perfect correspondence between reality and

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simulation is infeasible. With respect to the correspondence between my simulation-generated measures and their empirical real-world correspondents, I find that while imperfect, these measures do correspond fairly closely with empirical "real-world" derived measures. Additionally, I find that this correspondence is superior to that offered by rational choice. Hence, findings extrapolated from simulation to phenomenological reality are not only meaningful, they possess clear explanatory and theoretical superiority to commonly employed alternative approaches such as rational choice modeling. In summation, I relate these findings back to their initial theoretical grounding.

THE CRISIS-DRIVEN EVOLUTIONARY LEARNING MODEL

In developing my model of international systemic behaviour, which I have termed "Crisis-Driven Evolutionary Learning", I set out to abstract out relevant properties of phenomenological reality. My model was premised on the assumption that the international system constituted an *evolutionary learning system*. That is, that it *learned* with respect to system time. Successful incorporation of this assumption into the model required me to develop a *mechanism* for such learning to occur.

Among international systems theorists there is a noticeable lack of agreement concerning whether or not systemic-level learning occurs. Theorists such as Waltz (1979) and Gilpin (1981) assert that the international system does not learn. This view is strongly contested by other theorists such as Levy (1984), Modelski (1987, 1990), and Wang and Ray (1994). One issue pertinent to resolving this question, which has been omitted from this discussion, is that of the mechanism by which systemic learning might occur. Without addressing this detail the debate is doomed to remain largely theological. Scientific inquiry consists of proposing falsifiable hypotheses concerning epistemological reality. The mere assertion that a particular, ill-defined proposition is, or is not true, fails to meet this criterion.

I hypothesize that systemic learning does, in fact, occur. I call the proposed mechanism by which this learning takes place, "crisis-driven evolutionary learning." To better grasp this model, I will describe its operation through the flow chart diagram shown in Figure 1.

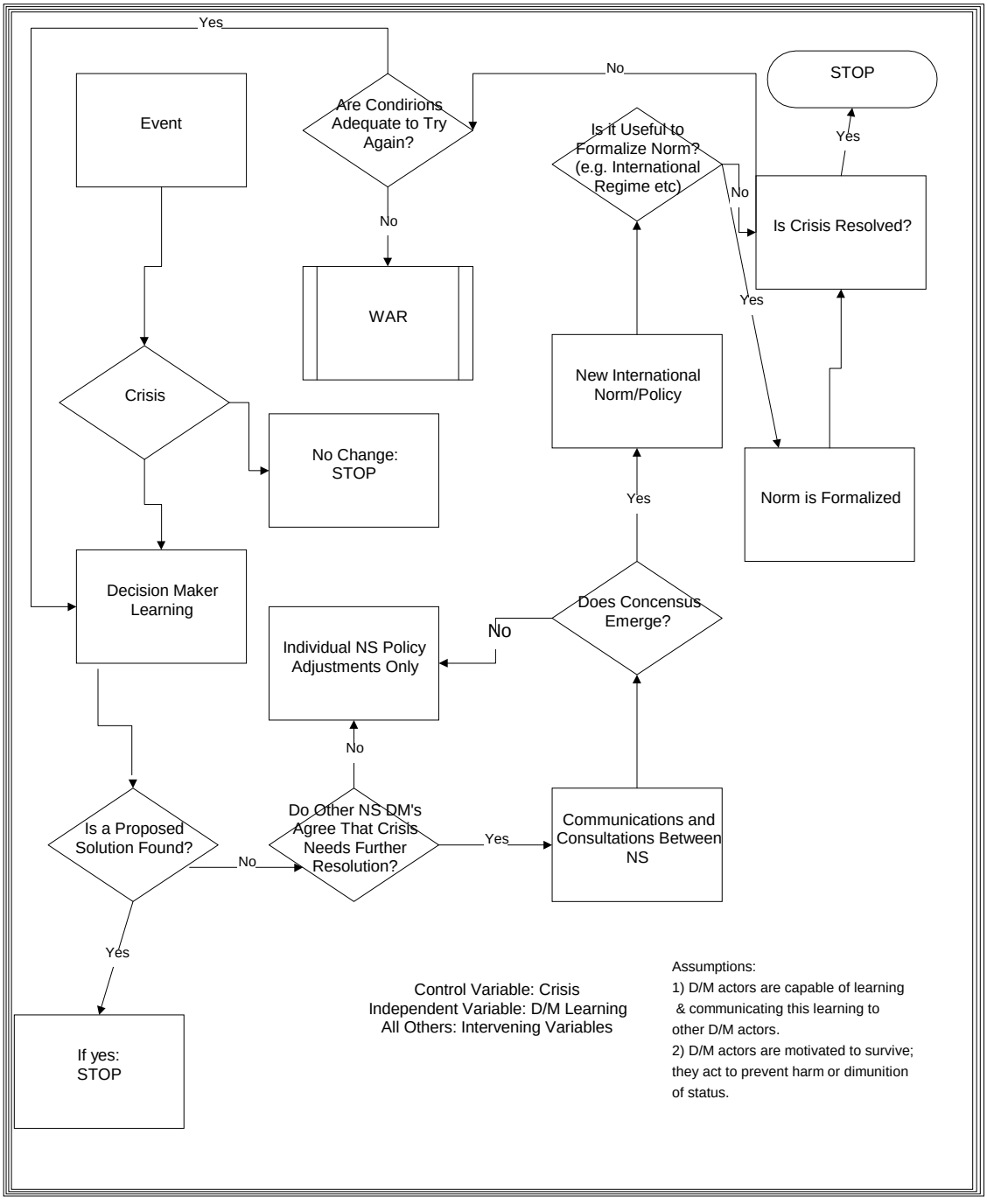

Figure 1

Proposed Evolutionary Learning Model.

Crisis-driven evolutionary learning is a systemic level theory that is predicated upon the integration of processes and informational flows, which occur at several levels of analysis. Conventionally, according to international relations theory, there are at least three distinct levels of analysis:

(1) The individual/decision-maker ("DM") level. This focuses upon discrete individuals, or small groups of decision-makers.

(2) The nation-state level. Here nation-states are evaluated as unitary-actor black boxes.

(3) The systemic level. In this analytical perspective the international system is evaluated holistically.

Referring to Figure 1, at the systemic level, events are continually occurring. Most events are routine and so can be dealt with by existent decisional procedures. Occasionally, an event, which cannot be so dealt with, occurs. This precipitates a crisis. Crisis is defined as any threatening, or unanticipated, eventuality which has the perceived potential to substantially reduce, or eliminate altogether, the well-being, or more precisely, *fitness*, of the international system and that cannot be resolved by application of existent decisional procedures. If such an occurrence were resolvable by existent procedures then it would not be a crisis, but merely a problem. No fundamental learning would occur, as existent algorithmic procedures would serve to resolve the problem. Any systemic crisis presents some threat to the orderly functioning of the national system (the nation-state level) with systemic consequences, and/or global system (the system level).

This impels decision-makers, acting on the basis of self-interest, in each affected nation-state to (individually, by nation) to attempt to develop solutions to resolve the crisis. They act in order to prevent a decrease in perceived fitness (that is they act to preserve existing utility). Various tentative solutions are considered thereby creating a "learning loop". This either results in a solution to the crisis, or does not. In either case, learning has occurred at the individual decision-maker level. If a solution can be obtained at the nation-state level, it is incorporated into the individual nation-state's structure. If not, then the crisis likely requires a larger scale (i.e. systemic level) solution. If this is so, then other nation-states should also be affected. A fundamental crisis would lead these nation-states to seek to cooperate in order to prevent harm, or destruction, from occurring to all of them--although each would be acting out of self-interest in order to "save" itself. Thus, systemic level crises *require* inter-national cooperation for resolution. Given this commonly perceived need to cooperate among nation-states, communications and consultations occur. In effect, this links multiple individual nation-state decision-maker learning loops together. New decision-maker-mediated knowledge is created. Regarding this process Ernst Haas explicates that: "Knowledge is the professionally mediated [i.e. via epistemic communities] body of theory and information that transcends prevailing lines of ideological cleavage. Internationally then, the sharing of a fund of knowledge among governments is a form of cognitive convergence" (Haas 1990: 386). If a consensus fails to emerge, the system may, much like an out of tune motor, function less efficiently, prompting several more iterations of attempted learning (i.e. repeat the previously described process) until an output becomes possible. Alternately, the crisis may be transitory (for example a one-time epidemic, earthquake, or other sporadic catastrophe) allowing the system to return to its pre-crisis structure.

For crises resulting in a systemic output, decision-maker learning may be informally incorporated into system structure as a new norm. If useful, this norm may subsequently be formally incorporated into the system's structure as a new coordination and decisional body (e.g., as an international regime). If this learning process definitively resolves the crisis, no further change to system structure, due to learning, occurs. If not, either the process repeats as many times as necessary to develop new decisional algorithms to deal with the crisis, or nations attempt to impose unilateral solutions, which triggers warfare.

The only assumptions are: (1) Decision-makers are able to learn and are capable of communicating this learning to other actors who are likewise endowed with the ability to learn. (2) Individual actors seek to prevent harm from occurring to themselves.

This second assumption is predicated upon actors responding to challenges to their existing level of well-being. Thus, they are utility preservers. The net effect of these assumptions accounts for why the whole process is crisis-driven. Additionally, because crises occur irregularly, change is proposed to occur in discrete "chunks". These chunks represent crisis-instigated schematic rearrangements of decision-makers cognitive mapping of reality. These cognitive changes are then subsequently integrated into the structure of the global system in the form of new algorithmic structures such as international regimes.

Modelski's (1987) long cycles can be construed as comprising learning on the part of individual decision-makers responding to periodic systemic crises. This individual learning is subsequently incorporated into the system's structure. The effect of this is to resolve the prior systemic crisis. Thus, the Modelski model can be subsumed into, and explained by, evolutionary learning. It is essential to state explicitly, that these systemic, crisis-driven, learning processes function in response to all systemic crises, at any time that they may occur. Crises continue to occur throughout the Modelski cycle, and so, logically, must systemic learning continue to occur also. The key insight is that these ongoing systemic crises do not lead to fundamental systemic restructuring in this paradigm, as by definition, such restructuring *is* the effect of a complete long cycle.

Also, this crisis-driven learning model is equally applicable to an aperiodic cyclical model (e.g., Goldstein 1987, 1988, 1991). Evolutionary learning is not necessarily contingent upon a systemic theory predicated upon periodic cycles (that is, it is neither necessary nor sufficient). It's learning process can be understood to represent the process of replacing maladaptive conceptual schemas with "fitter" ones (i.e., better adapted to the changed systemic environment).

Indeed, political theorist Ernst Haas observes that old, or maladaptive, cognitive modes are supplanted by better adapted ones in a manner analogous to Darwinian natural selection: To evolve cognitively requires the ability to change one's behavior by reconceptualizing the world of organizational activity in a more holistic, more interconnected manner after first disaggregating a causal schema found to be unsatisfactory. The recognition of a more complexly linked scheme with more parts than the original one, however, must then be followed by the attempt to disaggregate the whole in order to make organization possible. In other words, cognitive evolution encompasses the ability to compose, and then decompose, a nested problem set, provided that the consensual knowledge of the moment suggests that the resulting scheme is better than the previous one. Cognitive evolution means the ability to make

choices intended to provide a "nearly decomposable system" of coupled parts (Haas 1990: 192).

Haas's observations suggest that a useful way to think of crisis-driven learning is, effectively, as an ongoing process of cognitive evolution occurring in the context of an ever-changing systemic environment.

Finally, it is important to understand that evolutionary learning is a holistic process. Decision-makers can be looked at as being information processing nodes that synthesize several inputs together to produce a new output. Once new systemic structures have been incorporated into the system's existing structure, the flow of information that is channeled through these individual level decision-makers is altered. This alters the context in which decision-making occurs, and hence, alters the nature of the decision-maker node's output. The chain of causes and effects thus forms a seamless web of interactions.

Overall, crisis impels nation-state decision-makers to either develop cooperative solutions to system-wide problems, or failing this, to engage in inter-state warfare, with the ultimate victor imposing a "solution" upon the other states. However, as the power available to warfare participants has been increasing rapidly, this option seems less likely to be resorted to over time. The net effect is that the international system is continuously integrating new decisional structures in the form of bodies such as international regimes, into its structure. Consequently, the international system becomes more informationally complex, more decisionally versatile, with respect to time. Simply put, the system learns over time.

We are now ready to develop the formal model that will be utilized to test this theoretic approach.

My model is designed to test the hypothesis that the modern international political system is a complex adaptive learning system. To evaluate this hypothesis I utilize a singular predictive instance ("SPI") of systemic behavior. This is warfare frequency. Warfare frequencies are selected because empirical data for the 1495-1975 time period (Levy 1983) are available. These data allow for falsifiable testing of my computer model (Byron 1996, 1997) for crisis-driven systemic learning.

Systemic learning, with respect to warfare frequencies, is hypothesized to have occurred in response to accelerating growth in total systemic power. These increases in power cause the adverse consequences of warfare, in general, and great-power warfare, specifically, to evince a corresponding escalation. This creates "selection pressure" upon the system to "learn" to avoid this mounting danger to its existence.

My investigative strategy was to utilize MS QUICKBASIC to create a model international system program. The results obtained from running this program are employed to generate data for this SPI. These data are then evaluated in the context of Levy's data. This allows for falsifiable testing of the study's complex adaptive learning system hypothesis while validating extrapolation from model system data to real world data.

The model system consists of ten mutually interacting actor-elements that represent the nation-state constituents of the world political system. This value was chosen for several reasons. Levy (1983), in his study of great power warfare between 1495 and 1975, identifies a cumulative total of fourteen great powers. Thus, the model is consistent with actual

phenomenological reality. Also, ten represents a sufficient number of actors to permit the hypothesized systemic learning processes to be detected, if existent, while still remaining a small enough value to allow for maximal analytical clarity. This value remains constant because of my observation that none of Levy's (1983) fourteen cumulative great-powers has ceased to exist during the 1495-1975-study period.

In conceptualizing the structure of the world system I envisioned that its several levels of analysis (i.e. individual/decision-maker, nation-state, systemic) were, although analytically distinguishable, integrated together into a coherent whole. Pursuant to this, I incorporate two basic individual level cognitive precepts into the computer model: (1) Awareness is limited. It is a zero-sum variable (Simon 1985: 302; Simon & Kaplan 1991: 9). (2) Cognitive change occurs discretely. This assumption follows logically from the realization that awareness is limited. Given this attentional constraint, information is stored associatively, probably in a schematic arrangement (Schater 1991: 692). This allows for rapid associative retrieval of stored information. The human brain is limited to performing no more than about 100 associational steps per second (Rumelhart 1991: 135). Aggregate schemas for any given subject comprise "memes". This form of information storage allows for rapid information retrieval, and utilization, within the limited attention, "100 step" constraints imposed by the brain's architecture. Decisional outputs of state level actors are assumed to conform to these individual level cognitive constraints due to the concentration of inter-state decisional power among relatively few leaders.

Possession of a common meta-meme among individual level actors within a nation state is represented in the context of the model as comprising that actor's culture. Culture thus acts as a constraint upon state behavior towards other states. In particular it determines a state's propensity for reciprocal behavior. Reciprocity is the model's indicator for democracy. Given the theoretical (Doyle 1985: 1986) as well as empirical (Levy 1983) observation that democracies do not wage war upon one another, level of democratization is hypothesized to be a key variable defining nation-state behavior.

My computer model of crisis-driven learning is predicated upon the hypothesis that systemic level learning occurs principally in response to crisis. Crisis, in this context, is defined as any situation in which the application of previously encoded knowledge fails to resolve some situation in a manner in which harm, or the potential for harm, is averted. Because culture represents a common meta-meme between citizens of a given nation-state, it follows that any change in its configuration is likely to be resisted, as it will entail significant changes among a given cultural meme's associative linkages. Thus, it follows that cultural change will likely occur discontinuously, by discrete increments, which represent replacement of entire memes within the greater cultural meta-meme. This change will likely occur only when it is "forced", that is, in a crisis situation.

Models can be either "top-down" or "bottom-up". That is, the model's global properties can be pre-defined algorithmically, or they can arise from unpredictable interactions between actors executing instructions locally. I have chosen a mixed approach in which certain global properties of the model are algorithmically pre-specified, while local interactions among the system's actors determine its evolution. Thus, one interesting feature of this model is its interplay between deterministic, top-down, global rules, and non-predictable, bottom-up, actor

interaction effects. This effect is consciously designed to mirror the interplay of deterministic and non-deterministic phenomena that underlay actual reality. The model consists of four global, top-down, difference-equation-driven variables along with another variable that sets an upper limit upon one of these variables. These variables are modified in value via local, bottom-up, interactions among system actors by operation of a WAR subroutine and a CRISIS procedure. Figure 2 offers a schematic overview of this model.

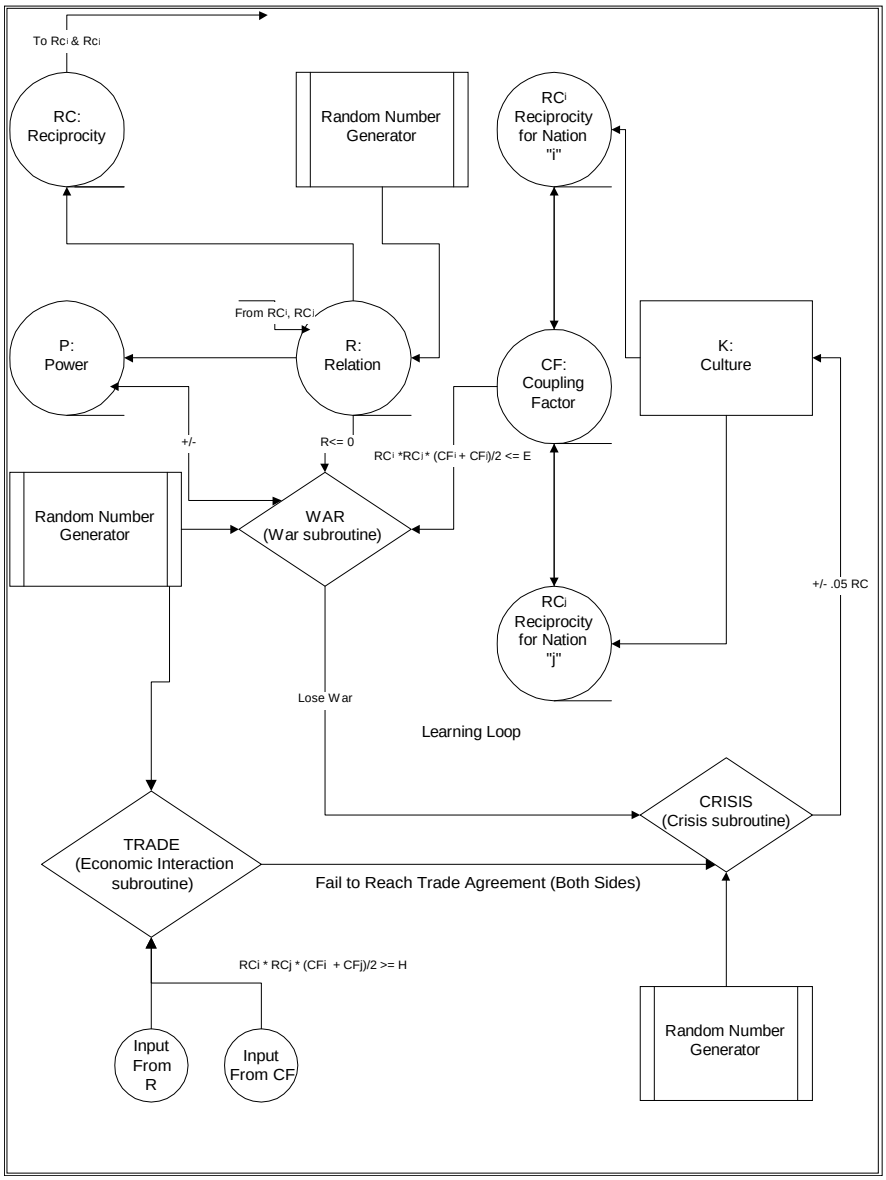

Figure 2

Information Flows Between and Among Model Variables and Subroutines.

The four algorithmically defined variables are: (1) Relation, (2) Reciprocity, (3) Power, and (4) Coupling. Each is constructed as a difference equation. As such, each imparts global, top-down' properties upon the model international system. Interested readers may find technical details regarding each of these variables and subroutines in the Appendix.

ANALYSIS

Having developed my model as described above, it is now feasible to show how and why this type of theoretical approach is more useful than others commonly utilized. Since the most prevalent approach currently in use in the social sciences is rational choice modeling, I will explain how and why this theoretical perspective is *superior* to that offered by rational choice.

To do this it is necessary to briefly review the basic concepts of the philosophy of science as developed by philosophers such as Popper (1957, 1982, and 1983), and refined by their successors such as Watkins (1988). This review cannot be comprehensive. However, it should clarify the basic premises and methodology of logical analysis insofar as they apply to the present inquiry. The consequences of the distinction made just above between utility preservation and utility maximization will then become comprehensible.

The idea that natural, as well as social, phenomena, are capable of being evaluated according to some type of logical methodology has been in existence at least since classical antiquity. In the modern era several fundamentally new insights into the possible scope, as well as methodological framework of logical analysis have been obtained. One of these is the idea that scientific inquiry proceeds from theories of lesser predictive power, towards theories of ever-greater predictive power without, necessarily, ever reaching a final all-encompassing universal theory. In discussing why there cannot, even in principle, ever be an ultimate, final, theory of everything, Popper states:

> An even stronger result is implicit in Godel's famous incompleteness theorem of the incompatibility of formalized arithmetic (though to use Godel's theorem and other metamathematical incompleteness theorems in this context is to use heavy argument against a comparatively weak position). Since all physical science uses arithmetic (and since for a reductionist only science formulated in physical symbols has any reality), Godel's incompleteness theorem renders all physical science incomplete; which to the reductionist shows that all science is incomplete. For the non-reductionist who does not believe in the reducibility of physically formulated science, science is incomplete anyway.
>
> Not only is philosophical reductionism a mistake, but the belief that the method of reduction can achieve complete reductions is, it seems, mistaken too. We live in a world of emergent evolution; of problems whose solutions, if they are solved, beget newer, and deeper problems. Thus we live in a universe of emergent novelty; of a novelty, which as a rule is not completely reducible to any of the preceding stages (Popper 1982: 162).

As will be discussed in detail in the subsequent section of this paper, the phenomenological universe contains a plethora of systemic phenomena that evince emergent properties. As Popper notes, they evince properties that cannot be reduced to the arithmetic

summation of their constituent parts. In explaining phenomenon at one level, we must next confront the emergent properties of these phenomena. This requires a more fundamental, or in philosophy of science terminology, "deeper", level of theorizing. At this deeper level, theories become more general, and consequently, more predictively powerful.

Next, the question arises as to how to go about this process of hypothesis-based inquiry into the phenomenological universe. The traditional consensus was that logic alone would suffice. However, over time, doubts regarding this axiomatic shibboleth arose and intensified:

> A demonstration really based upon the principles of Analytical Logic will be composed of a succession of propositions; some, which will serve as premises, will be identities, or definitions; others will be deduced from the former, step by step; but altogether the connexion between each proposition and the succeeding proposition can be grasped immediately, it is not obvious at a glance how it has been possible to pass from the first to the last, which we may be tempted to look upon as a new truth. But if we replace successively the various expressions that are used by their definitions, and if we pursue this operation to the furthest possible limit, there will be nothing left at the end but identities, so that all will be reduced to one immense tautology. Logic therefore remains barren unless it is fertilized by intuition (Poincare 1952: 193).

The idea is that theories cannot be "proved" by the application of logical axioms. Although Poincare's methodological failing lies in not operationalizing how one might go about "fertilizing by intuition" one's theories, philosophers of science such as Poincare set the stage for others, such as Popper and Watkins, to identify, and articulate such a methodology. The initial agenda required that the question regarding how scientific inquiry should proceed (or what is the aim of science) be articulated:

> the conjecture that it is the aim of science to find satisfactory explanations leads us further to the idea of improving the degree of satisfactoriness of our explanations by improving their degree of testability, "i.e.", by proceeding to better testable ones; which means…proceeding to theories of ever richer content, of a higher degree of universality, and a higher degree of precision. This, no doubt, is fully in keeping with the history and actual practice of the theoretical sciences (Popper 1983: 134).

Popper (1959) articulated the fundamental insight underlying logical analysis. It states that experience should negatively control scientific hypotheses. This insight became known as the falsifiability criterion. In Watkins it is termed proposition II* (1988: 118.) Watkins also articulates another proposition--proposition IV*:

> it is rational, given evidence e, to adopt the hypothesis h, if h is unfalsified and provides the best available explanation for e. The sought-for relation between e and h is now inverted: instead of an upward, quasi-verifying inference from e to h we have a downward, explanatory derivation of e from h. Of course, this proposition [IV*] needs to be filled out by a clear specification of what it is for one explanation to be better than any available alternative (Watkins 1988: 118-9).

This is, of course, a formalization of Poincare's above quoted insight that "[l]ogic therefore remains barren unless it is fertilized by intuition" (Poincare 1952: 193).

Watkins finds that the optimum aim for science, which he calls B* consists of five components: A*, B1, B2, B3, and B4. Further B1 and B2, as well as B3 and B4 form unitary groupings, or 'poles'. Watkins defines A* as follows: "Science aspires after truth. The system of scientific hypotheses adopted by a person X at any one time should possibly be true for him, in the sense that, despite his best endeavors, he has not found any inconsistencies in it or between it and the evidence available to him" (Watkins 1988: 155-6).

The B components are defined by Watkins as comprising:

(B1) to progress towards certainty with theories that are ever more probable;

(B2) to progress towards one unified science with theories that are increasingly unified;

(B3) to progress towards potentially complete predictive power with theories that are ever more predictively powerful;

(B4) to progress towards absolute exactitude at all levels with theories that are increasingly exact.

Watkins somewhat simplifies this arrangement stating that:

> Thus it turns out that our optimum aim for science [B*] is less diverse than it may have originally app. eared. It consists of (A*), the requirement concerning the possible truth of an accepted system of scientific statements, plus two demands, (B1-2) and (B3-4), which could be epitomized as the demands for increasing depth, and increasing width: science should try to penetrate to ever deeper levels with theories having an ever wider coverage at the empirical level (Watkins 1988: 220).

Per Watkins, theories vary in their testable content (CT). Ceteris paribus, given two, or more, theories, the one with the greatest testable content is logically preferable. The greater the testable content (CT) of a theory, the greater the number of potential falsifiers (PF) of that theory. This is intuitively obvious: the greater the phenomenological domain of the theory, the greater the number of phenomena, subsumed by the theory, which by (potentially) failing to behave according to theoretic predictions, can, potentially, falsify the theory. Each individual phenomenon that could falsify a theory is a PF of the theory. A singular predictive instance (SPI) of a theory is simply the negation of a PF. This is also intuitively obvious, as the theory predicts the particular phenomenon (making it an SPI of the theory by definition). If it were to fail to conform to this predicted behavior it would falsify the theory (making it a PF of the theory by definition). Watkins distinguishes between a theory's (potentially) testable content and it's empirically (actually) testable content. Empirically testable content is designated as Ct. It is always equal to, or less than, CT, a theory's (potentially) testable content. This relationship is also intuitively clear, as not all of a given theory's potential testable content may actually be operationalizable at a given time, although the possibility of testability remains. The relationship between Ct and potential falsifiers, PF's, as well as singular predictive instances, SPI's, is identical to that of CT allowing for the potentially reduced scope of Ct with respect to CT.

Also per Watkins, theories have of a theoretic core, TH. More powerful theories consist of a theoretic core (TH), plus one (or more) auxiliary assumptions (A). The relationship between TH and A is: (TH + A) > (TH & A). Thus, theories that possess equivalent theoretical cores, in terms of testable content, may yield divergent quantities of testable content once some

auxiliary assumption is incorporated into the theory. Again, those theories that possess the greatest testable content are logically superior to those that possess lesser testable content, ceteris paribus. Theories that are deeper, and broader (Watkins's B1-B2, and B3-B4 poles), by definition, possess greater testable content. Thus, increasing testable content, ceteris paribus, is indicative of increasing theoretic depth and unity.

With these several criteria in mind, we may now proceed to evaluate the schematically/memeticaly predicated theory of crisis-driven evolutionary learning with respect to the alternative theory of rational choice/expected utility.

Evolutionary learning and expected utility/rational choice theories rest upon distinguishable assumptions: utility preservation versus utility maximization. This distinction, (utility preservation versus utility maximization) offers a basis for testing the two types of theory: Does societal (systemic) learning occur predominately during times of crisis, while otherwise tending towards status-quo maintenance, as evolutionary learning would predict? Or, conversely, does systemic learning and concomitant flexibility occur more or less continually, driven by the desire to better one's lot (to maximize utility)? There ought to be a testable difference.

The observed empirical regularity is drawn from studies regarding the relative frequencies of wars in general, and more specifically, great power wars, across a 1495 to 1975 time frame. Principle sources for these data are Levy (1983) and Bueno de Mesquita (1981), Wang and Ray (1994) extend some of these data to 1991 as well. Expected utility/rational actor theorizing fails to account for certain observed empirical patterns in these data. Succinctly, the frequency of great power wars is found to decline over time in a manner that is not congruent with the observed frequency of other types of wars over time. My basic thrust, to deal with this problem, will be to compare and contrast the above-articulated evolutionary learning mechanism with the 'standard' rational choice/expected utility, in terms of Watkins' several criteria for comparing and evaluating theories.

My proposed alternative theory to rational actor/expected utility theory devolves upon the issue of whether, or not, world politics constitutes an evolutionary learning process. Wang and Ray (1994) make just such an assertion. They state:

> This [their previously discussed empirical findings] might be interpreted as evidence that world politics has involved an evolutionary learning process (Modelski 1990). Decision makers in the major powers, in other words, may have 'learned' over the centuries just how dangerous it is to initiate wars against major power opponents, and have accordingly become increasingly selective in their choices of targets for war initiations. And since 1945, major powers have not initiated wars against major power opponents (Wang & Ray 1994: 150).

Thus, the Wang-Ray model hypothesis is not that the frequency of wars, in general, decreases over time. Nor is it that the frequency of great power wars decreases over time. (Although they do find this to be the case (Wang and Ray 1994: 149).) Rather, it is tightly focused: The observed frequency of great power versus great power wars, which are initiated by a great power, is predicted to decrease across the 1495 to 1991 time period. The causal mechanism for this is attributed to the operation of an evolutionary learning process. According to this model,

for the 1495 to 1991 time period major powers are hypothesized to have "learned": (1) That it is dangerous to initiate wars against other great powers; (2) consequent to this, they have become more restrictive in their targeting of states by evincing an increasing avoidance of targeting other major powers. The empirical data upon which this learning is predicated is presented in Wang & Ray (1994: 150, Table 6). In summary, these data indicate that: (1) Great power initiators of wars against other great powers lose a disproportionate amount of the time, both absolutely, and with respect to the probability of losing a great power initiated war against a minor power; (2) the resultant win/loss gap has increased in magnitude, in both relative, as well as absolute terms, across the study period.

If the Wang-Ray hypothesis is empirically sustainable, then the frequency of great power versus great power wars should be observed to decrease with respect to time. However, the frequency of great power versus minor power wars should not evince a corresponding decrease. This is because there is no lesson regarding the "dangerousness" of this type of war to be learned according to the Wang-Ray data.

According to rival hypotheses, such as the several variants of expected utility/rational actor models, each great power would assess its probability of success against another great power *de novo*. This is much like the situation with a coin toss: each specific instance is unique and is not affected by past occurrences of the event. Thus, this type of model does not require an assumption that past outcomes have some bearing upon the outcome of present interactions. Restated, there is no assumption of "learning" involved with this type of model. For example, the expected utility model presented by Bueno de Mesquita (1981) involves no such learning assumptions. Each great power's utility function calculation is independent of all events that have preceded it. While this is not an inevitable consequence of this type of theory, it is consistent with the theory as generally presented. Any other form of the theory would require explicitly stated assumptions to account for "memory" or "learning". The effects of such assumptions upon the theory's core would be unknown. As Bueno de Mesquita (1981) does not make such assumptions, they cannot be evaluated in this context.

Where the evolutionary learning model diverges fundamentally from the expected utility model is in proposing that actual "learning", which influences the outcome of subsequent great power versus great power war/no war decisions, is occurring. This leads to testable differences in outcome between the two models. If empirical evidence consistent with the Wang-Ray model were obtained, would this necessarily lead to the conclusion that such an evolutionary learning process was occurring? Consider that any alternative explanatory model would have to account for why great powers continue to initiate wars against minor powers with undiminished frequency (Wang and Ray 1994: 150, Table 6 and 151-53, Appendix), while the frequency of great power initiated wars against other great powers has declined across time, and has become zero for the past half century.

Ceteris paribus, the evolutionary learning model easily accounts for these observed findings, whereas expected utility type models cannot. It follows from this that the evolutionary learning model allows for more detailed, precise, predictions, than does expected utility.

Recall from Watkins that each potential falsifier of a theory entails a *singular predictive implication*. If PF represents such a potential falsifier, then ~PF (read the negation of PF)

represents such a singular predictive implication. Thus if great power wars become more infrequent over time, according to the evolutionary learning theory, then the statement; 'there will not be a great power war during the second half of the twentieth century,' is an SPI of the theory (Watkins 1988: at 4.41). Consequently, this greater precision of prediction represents a level of theorizing superior to that of the expected utility model and, moreover, it follows that evolutionary learning is more easily falsified (that is, conventional expected utility type theories make no predictive distinctions between relative frequency of major-major and major-minor wars over time, whereas the evolutionary learning model does). Expressed in terms of symbolic logic this above described relationship may be represented very simply as: $Tc(t1) > Tc(t2)$ where Tc represents the theory's empirically testable content, t1 represents the evolutionary learning model, and t2 represents an expected utility model (such as that articulated by Bueno de Mesquita (1981)) (see Watkins 1988: at 4.22, 5.12). Therefore, according to this line of reasoning, an empirically supported theory with greater testable content must be selected over one with lesser testable content, *ceteris paribus*. It should be explicated that testable content in the Watkins sense refers to empirically verifiable predictions arising from the theory itself. Thus these theoretic predictions are tested against empirically observed phenomena (see Watkins 1988: at 3.5, 4.5 re derivation of A*). If one theory allows for more discrimination, or resolution, or detail, for which testing to be conducted, then, it has a greater testable content than the other. That is, has a greater numbers of potential falsifiers (and as documented above, of SPI's). As described above, this is the case for the evolutionary learning model, which can discriminate between major-major power wars and major-minor power wars in a manner that general expected utility models cannot (see Watkins 1988: at 5.24).

Objectively, we could simply treat both models as black boxes that somehow produce outputs. These outputs could then be compared against one another in the matter described above. However, expected utility models do posses a type of theoretical structure, along with a causal mechanism. Logically, a competing theoretic approach such as evolutionary learning ought to posses at least as detailed a theoretic structure and associated causal mechanism. As has been evinced elsewhere, the evolutionary learning mechanism does, indeed, possess such level of detail.

Wang and Ray (1994) cite several sources for the evolutionary learning model. Modelski (1990: 9-10) sketches several aspects of such a theoretic construct: (1) societal learning cannot be reduced to individual (or an aggregate of individual) learning; (2) learning is incorporated as changes in system structure. This is done to account "...for problems that represent evolutionary challenges" (Modelski 1990: 10). Ray (1989) attributes such learning to changes in international norms regarding behavior among and between great powers. Unfortunately, there is no detailed explanation offered as to how such a systemic learning process occurs. Wang and Ray merely state that such a thing may be occurring. By way of explanation, they cite Modelski (1990). Modelski (1990), unfortunately, also fails to provide any falsifiable model for how such a process could occur. Instead, he simply makes conclusionary statements such as given above about learning being a systematic not an individual level process. One might reasonably ask: How? Why? Regrettably, there is no answer. If this were the state of development of the evolutionary learning model, then it would

fail the falsifiability test. If so, then expected utility would "win" by default. This is because comparing theories by testable (predictive) content is predicated upon the assumption that both theories are themselves falsifiable. Violation of this assumption would invalidate the comparison. To prevent this from occurring, I am positing a detailed causal model with corollary assumptions.

Returning to our comparison of the two types of theories (learning and utility) with respect to the Bueno de Mesquita (1981) data set, we now find that the above given assumption of *ceteris paribus* is not violated. The evolutionary learning model provides at least as coherent a causal explanation as does the expected utility type of theory. This leads to the conclusion that: (K(t1) $\geq$ K(t2) where K represents logical coherence, or internal self consistency, while t1 and t2 represent evolutionary learning and expected utility theories, respectively). At the same time, evolutionary learning also possesses greater explanatory utility, as evinced by its greater testable content. (Expressed analogously, all potential falsifiers of t2 are also potential falsifiers of t1, however, the inverse relation does not hold. Not all potential falsifiers of t1 are potential falsifiers of t2). The inescapable conclusion is that there is no 'magic' involved in invoking the evolutionary learning model—at least no more (and perhaps. somewhat less) than is involved in invoking the expected utility type of model.

Thus if crisis as the primary driver of systemic learning forms an auxiliary assumption, A, to the theoretic core of t1 the systemic learning theory, and arbitrary, capricious, and unexplained assumptions are appended to rational choice theory to account for the chance in frequency of great power wars across time, A', then we get: (i) CT(t1) > CT(t2); (ii) CT (t1Th + A) > CT (t2Th + A') . Of course, (t1Th & A) < (t1Th +A), per Watkins (1988: at 5.32). This is because crisis, taken in isolation from the theories above articulated theoretic core, is of relatively little theoretic utility, while the evolutionary learning theoretic core, without the auxiliary assumption of the role of crisis in driving systemic learning, is in no better a theoretic position than is rational choice—both must then depend upon ad hoc heurisms to account for the discrepancies between the empirical data and the theoretic predictions. As A cannot stand apart from t1Th, it is a unified theory. For rational actor theory, A' being an ad hoc heurism of some type, cannot meet this criterion of unity. Thus evolutionary learning is more unified than rational actor theory, in the context of these time-series, empirical data. Also, as developed above, t1, evolutionary learning is deeper than is t2, rational choice, in the sense that it subsumes previously unrelatable observations of social phenomena (e.g. the rapid decline in frequency of great power wars *and* the slower decline in non-great power versus great power wars, as well as much else, into a common, causal, theoretic structure, which rational choice is simply unable to account for). Thus, the B1 and B2 components, per Watkins, indicate that t1 is a deeper, and more unified, theory than is t2.

The conclusion to be drawn is that if the evolutionary learning model is able to account for empirical findings regarding great power versus great power wars, as well as great power versus minor power warfare, for the 1495 to 1991 (or approximately this time frame) as well, or better than expected utility, it is logically to be preferred.

This raises the issue of whether the evolutionary learning model can accomplish this, above described, task. Wang and Ray (1994: 143-144) employ an idiosyncratic methodology for selecting the initiators of wars, as well as the winners of these wars. For this reason, any

conclusion in favor of the evolutionary learning model over the expected utility model that rested solely upon these data would lack empirical robustness. Accordingly, if other studies that were not conducted with the evolutionary learning approach in mind nevertheless produce findings consistent with this theory, then it (evolutionary learning) would acquire substantially enhanced robustness.

Wang and Ray's (1994) key findings for the 1495 to 1991 time frame have been presented above: (1) the overall frequency of great power wars has diminished; (2) the overall frequency of great power initiated wars against other great powers has decreased substantially across the study's time frame--the most precipitous decline for the 19th and 20th centuries, with no such wars occurring in the past 50 years; (3) for all other types of wars (other than great power versus great power) initiators have been significantly more likely to win than their (minor power) targets only in the 19th and 20th centuries. Their conclusion is that the second finding above (2) evinces support for the evolutionary learning hypothesis (Wang and Ray 1994: 149-151).

If finding (2) above is valid, then finding (1) must follow logically, assuming, *ceteris paribus*, that the overall frequency of other great power wars has remained the same--or decreased (that is assuming no increase in frequency--the one change which would seem to run counter to expectations of the evolutionary learning hypothesis). As we shall see presently, this conclusion will prove useful in evaluating Levy's (1983) data set below. Finally, finding (3) presents difficulties for Wang and Ray. They state: "The apparent difference in success rates for initiators in the earlier and more recent centuries we report here constitutes something of an anomaly for both types [expected utility and evolutionary learning] of approaches" (Wang and Ray 1994: 151).

One possible explanation, suggested earlier in this paper might be utility calculation that incorporates (or takes place in the context of) previous learning. With this, we next turn to Levy's (1983) data set and findings in order to evaluate the evolutionary learning model with respect to a data set, and along lines of inquiry, which are free of the idiosyncratic critique that might be raised against Wang and Ray's (1994) research.

Levy's (1983) study encompasses a 1495 to 1975 time frame. A unique data set developed by the author is employed. Levy's methodology differs significantly from that of Wang and Ray's. Levy provides data for frequency of great power wars, by century. Both five, as well as twenty-five year intervals are employed. His measurement criteria for great power wars are inclusive of all wars involving great powers. Unlike Wang and Ray, great power versus great power wars are not distinguished from great power versus minor power wars.

However, Levy's data do discriminate between minor power wars and those involving great powers. If the Wang-Ray evolutionary learning hypothesis is valid, we should logically anticipate that the frequency of great power wars would decline with respect to time. This decline should be both absolute, and also, with respect to minor power wars. It is this discrimination between the two types of conflict (great power wars and minor power wars) that provides the test of the theory.

Conversely, expected utility models ought not discriminate between the two types of conflict. Each conflict would simply arise as the result of a rational calculation between state actors independent of previous experience. Thus interaction between state actors bearing a

given power relationship (say 10 and 11 on some power index) ought to produce identical calculations (and hence outcomes) for the 16th as well as the 20th centuries. Also, if we specify some power index where a power factor of, say, 10 and above constitutes a great power (or any other rational quantification scheme), then the power calculations for any 10 and 11 dyad ought, logically, be identical for a 1.0 versus 1.1 dyad. In fact, this study's forthcoming computer model will be able to directly test this proposition.

The above imply that: (1) expected utility models ought to be unaffected by the outcomes of previous interactions for all nation state war/no war calculations; (2) there ought not be any distinction between power calculations for great power versus great power (i.e., 10 versus 11) and minor power versus minor power (i.e., 1.0 versus 1.1); (3) because past outcomes do not load upon subsequent outcomes, *ceteris paribus*, no trend should exist over time towards, or away from war. These implications allow for an empirical test of the two theories to be conducted employing Levy's data.

Two caveats: (1) Levy's data do not allow us to distinguish between winners and losers of the conflicts; 2) his great power wars data comprise two groups: (i) great power versus great power wars; (ii) great power versus minor power wars. Only component (i) is congruent with the Wang-Ray operationalization methodology. Thus, it is logically possible for the (ii) component to mask the effects of the (i) component. However, we should concede in advance that such a finding (masked or non-confirmatory of evolutionary learning predictions) ought to be considered as an empirical rejection of the model. This conclusion is based upon the calculation that, in order to obtain such ambiguous results, the (i) component would have to be quite small with respect to the (ii) component, over time. Or, alternately, (ii) would have to be increasing in value, over time, with respect to (i). A third such possibility would be some combination of the two contingencies given just above.

What are Levy's findings? Levy states: "The results are not perfectly congruent across all of these indicators, but some overall patterns emerge. In general, interstate war involving the great powers has been diminishing over time. There has been a strong decline in the frequency of war, particularly in the frequency of Great Power war" (Levy 1983: 135). Thus, as predicted by the evolutionary learning model, but contrary to the logical implications of the expected utility model, great power war is observed to be declining in frequency, both absolutely, as well as with respect to minor power warfare. Minor power warfare is also found to be decreasing in frequency, though to a lesser extent than is great power warfare. Regarding Wang and Ray's observation that great power warfare had declined markedly for the 19th and twentieth centuries, Levy's findings concur. He notes: "Over 75 percent of the great power wars occurred in the first half of the 480-year system (before 1735); less than 25 percent occurred in the last 240 years" (Levy 1983: 116). Thus Levy's empirical findings are found to accord much more closely with the predictions of the co-evolutionary learning model than they do with those of the expected utility model.

Overall, the evolutionary learning model has been found to compare favorably with the more conventional expected utility model. As noted above, these two theories are not, necessarily, mutually exclusive. Evolutionary learners may well be rational utility maximizers, although this is neither a necessary, nor a sufficient precondition for evolutionary learning. Nonetheless, evolutionary learning, as detailed above, is the more detailed theory.

Accordingly, given empirical substantiation, it appears to offer the closer approximation to actual 'reality' (that is the actual event matrix for the indicated time frame). While expected utility models need not be discarded, this comparison, admittedly limited in scope, suggests that it must accommodate to evolutionary learning—not the other way around.

This closer approximation with 'reality' means that t1 is more falsifiable than is t2, per Watkins's A* criterion. As developed above, t1 also possesses greater theoretic unity, as well as depth (the B1-B2 axis), along with superior predictive power and exactitude (the B3-B4 axis). Additionally, as we have seen, it possesses greater theoretical fecundity, arising from its crisis driven learning assumption, A, to its theoretical core, t1Th. Taken together, these several criteria, impel a conclusion that evolutionary learning, t1, possesses a substantially greater degree of 'truth-value' than does rational choice/expected utility, t2. However, I am unsure how to quantify this difference. Perhaps as the ratio of potential falsifiers of one to another? That is a measure of the degree of falsification a theory has been subjected to? This might seem logical as ~truth = false, but the question remains open.

The finding that increasing levels of aggregate, though not relative, power, leads to a significantly decreasing incidence of great-power versus great-power warfare, and to a lesser degree, a decreasing incidence of great-power versus lesser-power warfare, provides powerful substantiation for this study's evolutionary learning premise. This finding will guide construction of relevant portions of the study's forthcoming computer model.

Finally, before moving on to the construction of this model, I would like, briefly, to address one potential objection to the above analysis that advocates of rational choice are likely to raise. They might assert that their theoretic framework could account for empirically observed decreases in war frequencies over time by positing that the destructiveness of warfare has increased dramatically, thus raising the costs of war. Nation states, as rational actors will consider these higher costs, thus reducing the expected utility of engaging in warfare.

A fundamental problem with this line of reasoning is that it is one-sided. Only increased costs are considered. No mention is made regarding potential increased benefits. For example, the United States certainly reaped huge, long-term benefits from its victory in the Second World War. The very variable that causes the higher utility costs, technology, also creates proportionately greater wealth. Thus the potential for gain has also increased in tandem with the potential for destruction. When both of these factors are considered together, the above argument becomes much weaker, if indeed it can be sustained at all as it becomes less plausibly true. A* decreases in other words. Also, theoretic depth (B1-B2) and breadth (B3-B4) are reduced as rational choice exponents, seeking to evade the above logic, must produce ever more convoluted, more specific, idiosyncratic scenarios to which their arguments might still apply. This is not the hallmark of a robust theory.

CONCLUSION

I have proposed a theory of systemic evolution in which the international system is posited as learning with respect to system time. I call this model "crisis-driven evolutionary learning". Pursuant to this I have articulated a detailed mechanism for the process of systemic

learning. These insights have been operationalized as a difference-equation driven model of the international system. This model is designed to test one SPI of the real-world system via its simulation. This testing allows for the model to be empirically corroborated or falsified.

These model attributes allowed for a thorough evaluation of my theoretical modeling technique, in comparison/contrast with the standard social scientific modeling paradigm, rational choice analysis, to be undertaken. This evaluation utilized a standard analytical framework that is grounded upon the fundamental axioms of the philosophy of science. The findings showed that my evolutionary learning approach possessed superior utility than did rational choice analysis for all possible categories of logical analysis.

The ultimate significance of this finding is that it demonstrates, in the context of a solid philosophy of science predicated, analytical framework, that a particular theoretical approach (evolutionary learning) is more suitable for empirical., scientific, hypothesis testing, than is the currently "standard" approach, rational choice modeling, which is generally employed in the social sciences. This finding, in turn, justifies my embarking upon a program dedicated to carrying out this testing.

APPENDIX

Relation, R: This variable has a range of between +1.0 and -1.0, for each of nation i's relations with other actors comprising the model international system. Equation 1 defines this variable in the context of the model for any two system actors i and j.

Equation 1:

$$R^{ij}_{(t+1)} = R^{ij}_{(t)} + b;$$

$$\text{where } b = ((.25 * (Rc^{i} * Rc^{j})/2)) * (R^{ij}_{(t)} - (\underline{R^{i+j}}))$$
$$(N-1))$$

The "b" term is subtractive as the model assumes that state actors possess limited quantities of attentional capacity. It incorporates the assumption that change occurs gradually under non-crisis circumstances. By including reciprocity, it assumes that more reciprocal states possess greater adaptability.

Reciprocity, Rc: This variable represents "level of democratisation", as articulated above. It is defined by equations 2a and 2b for any two system actors i and j.

Equation 2a:

$$Rc^{i}_{(t+1)} = 2 * \frac{(\sum {}^{+}R^{i}_{(t)})}{(\sum |R^{i}_{(t)}|)}$$

Equation 2b:

$$Rc^{ij} = Rc^{i} * Rc^{j}$$

This equation assumes that positive values of "relation" contribute to increasing power, for a given nation i, with respect to negative relational values.

Power, P: This variable represents total power that a given state, i, possesses at any time t. Equation 3a defines this variable and Equation 3b is the equation for the Renormalization of

Power:
Equation 3a:

$$P^{i'}_{(t+1)} = P^{i}_{(t)} + a;$$

$$\text{where } a = \left|\frac{(\sum {}^{+}R^{i}_{(t)})}{(\sum R^{i}_{(t)})}\right| + \left|\frac{[Q * (\sum {}^{+}R_{(t)})]}{(\sum R_{(t)})}\right|$$

$$\text{and } Q = \left|P^{i}\right| + [P^{total}/(45 - (5 * RC^{total})]$$

Equation 3b:

$$P^{i}_{(t+1)} = \frac{P^{i'}_{(t+1)}}{P_{(t+1)}}$$

The power equation assumes that propensity towards reciprocal behavior is conducive to increasing power.

Culture, K: This variable has a potential range of 0.00 to 1.00. Initial values of K are arbitrarily assigned. (Five nations are placed into a "high bound" culture with values of .75, while the remaining five are assigned to a "low bound" culture with K values of .25.) Subsequently, these values may be modified by application of the CRISIS procedure, as detailed below. K simply sets an upper limit for the potential range of state i's Rc values. Rc values are free to vary within the upper bound set by this limit. K varies by discrete increments of .05 because cognitive, or behavioral, change is assumed to occur discretely.

Coupling parameter, CF: The model incorporates a measure of how closely coupled any two nations i and j are at any time t. In effect, it determines the extent to which any nation i may interact with, and thus algorithmically influence, the behavior of a given other nation, j. Evaluated for the system as a whole (by computing its mean value) it provides a measure of the degree of "openness" of the system. The equations assume that perfect coupling can be closely approached, but never actually reached. CF is calculated in one of three ways. These are given below in equations 4a, 4b, and 4c.
Equation 4a:

$$\text{If } Rc^{i} < MRc: \quad CF^{i} = MRc - ((Rc^{i} - MRc)/2)$$

Equation 4b:

$$\text{If } Rc^{i} > MRc: \quad CF^{i} = MRc + ((Rc^{i} - MRc)/2)$$

Equation 4c:

$$\text{If } Rc^{i} = MRc: \quad CF^{i} = MRc ;$$

$$\text{where } MRc = Rc^{total}/(N-1)$$

WAR Subroutine: The model's WAR subroutine is triggered when the following criteria are met: IF $Rc^{ij}_{(t)} * ((CF^{i} + CF^{j}) / 2) \leq H$ AND $R^{ij}_{(t)} \leq 0$ THEN GOSUB WAR. When the model's WAR subroutine is triggered, the power renormalization process is reversed, or "denormalized", for each of the participating nations. This means that if two nations i and j trigger the WAR subroutine, their total, raw, power is calculated. This allows for the effects of increasing power upon warfare to be modeled. H is an algorithmically determined value.

CRISIS Subroutine: Nations that lose at WAR experience two outcomes: the first, a reduction

in their power, was mentioned above; the second is that they undergo the CRISIS procedure. Here, their K values are randomly raised, or lowered, by an increment of .05. The probabilities for each outcome are equal. This discrete value is selected in conformity with the model's assumption that cultural change occurs adaptively, by discrete intervals, corresponding to memetic replacement, in response to crisis.

In essence, via operation of the model's WAR subroutine, and its CRISIS procedure, each nation compares itself, dyadically, with all other nations. This comparison determines whether the two nations will engage in war, and if so, which one will initiate it. The effects of this process include substantial adjustments in power and, for losers at war, culture, and hence reciprocity. It is this local, interactive process that allows for the system's adaptive learning behavior to emerge locally within the context of its difference equation specified global structure.

TRADE Subroutine: This subroutine operates similarly to that of the WAR subroutine. The variable H represents its triggering threshold. The principle differences are that relations between nations i and j must be positive, (i.e. RC^{ij}) as opposed to negative, for the WAR subroutine. The triggering value (H) is, as is the case for the WAR subroutine, an algorithmically determined variable. Also, for purposes of this inquiry, if failure to reach a trade agreement occurs, *both* actors undergo the CRISIS procedure, and hence learning, as opposed to only the loser doing so in the in WAR subroutine.

My reasoning is that if crisis is modeled to be the primary driver of systemic learning, then any class of conditions, the failure of which would likely be perceived by system actors as creating harm to their well being, ought to be a generator of crisis. This is because of the fact that as both actors are similarly deprived of their potential gains both similarly experience crisis. Simply put, both, by being deprived of their potential winnings, become "losers". This triggers the CRISIS module. I should note that the CRISIS procedure is algorithmically triggered in this manner with between about one-fifth, to one-tenth, the frequency with which it is triggered by the corresponding algorithm located in the WAR subroutine. Both algorithms are in part deterministic, relying upon instant values of system variables, and in part stochastic, relying upon input from a random number generator. For high levels of reciprocity, trade-instigated CRISIS decreases rapidly, diminishing to zero at very high RC levels. This reflects my assumption that state actors generally perceive crises as offering less potential for harm than is the case for defeat in war.

COLLAPSE Subroutine: A final systemic parameter is generated by operation of the collapse module. This module algorithmically determines the probability that a warfare-prone system will collapse as a result of continuing warfare in the context of rapidly rising power levels. As there is insufficient empirical data to determine actual, real world historical probabilities, its values are, necessarily, somewhat arbitrary. However, they do provide a standard metric against which the effects of varying one or more systemic parameters can be evaluated.

Succinctly, the probability of systemic collapse is very low at low levels of systemic power. As power increases, so does the probability of collapse. For very high levels of systemic power it becomes unity. The collapse probability increases occur discontinuously; as a given power threshold is attained, the collapse probability rises correspondingly, in a stepwise manner.

Note that the BASIC language program utilized for this research is available, without cost or restriction, from: http://www.geocities.com/Athens/Acropolis/3956/hNEW.htm

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ART AS AUTOPOIESIS?
A CRITICAL APPROACH, BEGINNING WITH THE EUROPEAN MUSICAL AVANT-GARDE IN THE EARLY 1950S

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"AUTOPOIESIS", a concept coined by Maturana and Varela in the context of their biochemical theory of living organisms and later adopted by Luhmann in his theory of social systems, has also become the key concept of the latter's theory of art as a particular system of communication (Luhmann 1996). Although Luhmann insists that "from the unique biochemical invention of the autopoiesis of life it does not yet follow that there must be worms, birds and human beings; from the autopoiesis of communication which social formations (*Gesellschaftsformationen*) will appear in the course of the evolution; and from the autopoiesis of art which works of art will be created" (1996: 86-7), his theory seems to be adequate only to rare socio-communicative situations which emerged during the course of the history of European art. In particular, the postulation according to which "the essence of art is the self-programmation of works of art" (1996: 332) seems to find--for instance, in music--its only realization in some so-called serial works created in the 1950s by composers from the Darmstadt circle and in some manifestations of aleatoric music.

In fact, the development of serial thought in European music culminates in the 50s (with "integral serialism") in an ideal of musical composition in which the composer becomes increasingly merely an observer--of the first, second or even third order, in Luhmann's terms (1996: 92-164)--whose task does not consist of anything else but to display the consequences predefined by a serial matrix. Although the composer himself should create this matrix, covering all parameters, he was not allowed to modify in an arbitrary way during the course of the work, the consequential development predefined by the matrix. The "structural function in the process of autopoiesis of Art" (1996: 88), which Luhmann ascribes to the artist (in this case, the composer), came, therefore, into being only in this way.

Some writings by composers representative of this trend - for instance, Stockhausen's and Goeyvaerts's correspondence from the early fifties - seem to incorporate the concept of composition as autopoiesis and of the musical composition as an autopoietic system.

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Obviously without using the term, which had not yet been coined at that time, they postulated that works should compose themselves, according to immanent rules and in a way that seems to be very close to Maturana and Varela's concept of "living organisms" or Luhmann's social systems as "autopoietic systems". Accordingly, these composers excluded from the musical composition: (a) any "heterogeneous" idea or element; (b) any "external" intervention by the composer; and (c) the so-called "historical" dimension.

Homogeneity of the sound material, as opposed to heterogeneity, was considered one of the conditions for the emergence of a musical composition, just because the adding to or modifying of any element of the initial matrix was not compatible with the idea of an "organic development". Insofar as the different series--concerning pitch, duration, tone-color, dynamics (intensity), time, and so on--once postulated, were to remain unchangeable as organizational devices for the entire work, they were seen as a kind of genetic material. Although these composers could not yet know either the biological or the sociological concept of self-referential systems, their ideal of work seems to correspond entirely to that concept. In their approach, the work was able to progress only when its elements were able to safeguard what enabled it to exist as a system (with regard to a given environment). In their view, heterogeneous elements would destroy the system or would create a new system that they did not recognize as a valid musical composition.

Similarly, the composer was not allowed to take decisions concerning the "structure" of the work. As a mere "observer" and "accomplisher" of the generating serial principles on which the work was based, he had to put aside--during the process of the composition--any constructive idea that would contradict those principles. The development of the work as an autopoietic system imposed a strict consequentiality within the compositional process. Either the work emerged in these terms from the serial matrix, or it was destroyed as a system. Any decision that was not a consequence of the matrix had to be rejected as "arbitrary". Even the matrix might not be considered an invention or creation of the composer. As the Flemish composer Goeyvaerts postulated in his correspondence with Stockhausen between 1951 and 1954 (cf. Sabbe 1981), the "serial structure" was not "constructed", but "given". Even in 1986, Stockhausen also expressed the idea that human beings did not invent, but find the laws that rule nature and the universe, and that this was valid also for the composer. His task was thus to discover these laws, which are "given" and from which musical works should emerge. One could say that the composer was in this way placed in the position of an "observer" even before setting up the series; in so far as the series was not really invented, but "given", the activity of musical composition consisted in the observation of emerging systems and in the creation of conditions for their autopoietic development. Accordingly, the *Formeln* (formula) with which Stockhausen has always composed could be compared to a kind of pre-existent musical genome, which the composer "discovered" and "cultivated" in a way similar to a biologist in his or her laboratory (see Stockhausen 1986).

Besides, the work of music should appear, not as a segment of time or as a development in time, but rather as an object projected in space. Goeyvaerts describes this ideal using metaphorically the image of a time in which the music was "placed". Hence, he looked for the moments in which the Viennese composer Anton von Webern (who had died in 1945) had attained this ideal, but criticized him, because Webern's music, according to Goeyvaerts,

except for those moments, "happened in time" (*Geschehen in der Zeit*). What fascinated him in such music was precisely the "only-static", the "mirror-symmetric", that is, what seemed to fix musical time in space. By projecting itself in the total space of the composition, the "serial structure" was the very composition (see Sabbe 1981: 16ss). After finding the "given" "serial structure", the composer had only to take care of its projection in space. Any other intervention would signify the return to a music developing in time. This is also what Stockhausen meant with the notions of "history" as "pre-disposed creation" and of a musical work as a "temporal zero-point" (see Sabbe 1981: 70). The convergence with Maturana's concept of "living organisms", defined some years later, is evident: Maturana suggests similarly that the idea of an "aim" to be pursued and the idea of "evolution" belong to " a field which is separated from the field of the autopoietic organization of the living system" (quoted by Könnecke 1991: 132s).

One of the best examples for this conception of the works of music as "autopoietic systems" is Stockhausen's *Klavierstück XI* from 1956. In fact, the principles discussede above are assumed by Stockhausen and here also extended to the performance. This means that the composer avoided even the completion of the "serial structure" (in the sense of setting up one of its possible realisations). So, instead of presenting the piece, as is usually done, in a continuous sequence that the performer must play, Stockhausen spread out irregularly on a large sheet of paper (53x93 cm) nineteen discontinuous note-groups, representing different projections of the "serial structure" in space. The performer was then required to proceed in exactly the same way as the composer, that is to say, respecting what one could now call the "autopoietic" reproduction of the "serial structure". No heterogeneity, no external intervention, no development in time were allowed on this level either. In order that the result should be as close as possible to the principle of "autopoiesis", Stockhausen carefully defined the way in which the pianist should perform the work. Taking any conscious decision before or during the course of the performance, bringing intentionality or teleology into the work to be performed was forbidden. Thus, the sequential order and the way of playing the nineteen different note-groups were to depend only on chance. "The player casts a random glance at the sheet of paper and begins with whichever group he sees first", and this "casting a further random glance from one group to another" constitutes the only intervention allowed to the performer. The first group that happens to take the performer's eye is to be played freely--namely, with free choice of intensity, speed and mode of attack. But "the following group" ("any one that may happen to catch the eye of the player") "must then be played according to the directions printed after the first group". The procedure is repeated in a similar way with the following groups. Some regulations open infinite possibilities of, one could say, autopoietic reproduction: for instance, "when the performer comes to a group for the second time he is to respect the indications given in parentheses", which "will give the group a new aspect"; "when he comes to the same group for the third time, he then plays no more", the work will end. Accordingly, the duration of the performance is indeterminate (see Wörner 1963: 39-40, 104-5).

This piano piece was considered by Umberto Eco (1962) as a paradigm of the "open work". Nowadays, it can be seen, retrospectively, as a paradigm of a musical work as an "autopoietic system". In fact, it was conceived and it is to be performed in such a way that one could say, in Luhmann's terms, that "it reproduces its reproduction and its conditions of

reproduction" (1996: 86), in a way similar to a living organism, which reproduces itself becoming always different, and always the same (according to the "genetic imformation", which is carried in the process of reproduction).

In music, autopoiesis is therefore linked with the idea of separating the "work", its composition, also its performance, from any fact immediately related to the human or social experience of the musician, from any conscious decision he or she might take. This ideal, formulated by the serial composers, who started from a determinist way of thinking, gains still more coherence in John Cage's aleatoric music, in which nothing was predefined, not even the sound material from which the work would come into existence. Some of his pieces were entirely created, self-created, by chance. The composer had frequently only the role of defining the frame in which "music" could happen.

The case of the Italian Luigi Nono, one of the most representative serial composers (who was also well known in Darmstadt, the meeting point of the European musical avant-garde during the fifties), helps us, as a counter-example, to distinguish the afore-mentioned "autopoietic" conception of the work from other approaches within new music.

It should be stressed straight away that Nono was always in latent conflict with the dominant ideas among his colleagues. This conflict, later expressed very clearly in his numerous texts and declarations, was already apparent from his first works by means of the codified language of the tones. In contrast with the established canon of homogeneity, Nono used heterogeneous elements, that is to say, sound material or sound configurations that were not simply deduced from the series, but taken from other sound systems or even related allegorically to situations from the composer's life-world. For instance, in his work *Polifonica-Monodia-Ritmica* (1951), the serial composition was "contaminated" by the rhythm and pitch material from a Negro ceremonial song from Brazil, and in *Composizione per orchestra No. 1* (1951) he used the correspondence between certain tones and certain letters to quote in the series, for example, the name of Julius Fucik, a Czech literary critic who had been murdered by the nazis (Fucik represented by F/F#, Ut/C, Si, G). In both cases, the use of heterogeneous elements and the ideological background to which they were related were then silenced by Nono because of the dominant tendency in Darmstadt to think of new music self-referentially, on the basis of "pure" sound material.

Furthermore, Nono always accepted the principle of the freedom of decision of the composer during the entire process of composition. According to Nono, composing consisted simply in taking a position vis-à-vis the sound material: not the mere observation of an autopoietic process, but a real subject/object dialectic, which would be able to change the course of the work, was at stake. Hence he constantly brought into the work to be composed suggestions from his human experience - such as in the case of the above-mentioned works. Concerning *Polifonica-Monodia-Ritmica*, I quote from a letter published many years later the following lines:

> I tried, in this work, to express three successive relations with nature: "polifonica", constructed on an original Negro rhythm which was given to me by Catunda [the Brazilian composer Eunice Catunda] in Venice during your course, is a gradual approach to nature, while in "monodia" I find myself listening directly to the silences, to the songs [*canti*], to the echoes which it suggests and

> which let me participate in its primordial life, by making still clearer within myself the indestructible force-rhythm that is life itself (quoted by Borio 1987).

Sometimes these suggestions coming from real life could be so strong during the process of composition that the initial project changed substantially. A work originally conceived for piano solo and tape could be transformed in a work including feminine voices and a text paying homage to a dead friend, a leader of the democratic forces in Chile (*Como una ola de fuerza y de luz...* 1971). Engagement - including political engagement - and expression of his own feelings and convictions were behind the principle of decision which the composer, according to Nono, should never give up. This principle, or, in still stronger words, this *pathos of decision* distinguished Nono radically from other composers of the avant-garde scene. In a milieu in which music could be conceived and received as a self-referential system and the musical work as a de-semanticized object relating exclusively to itself, Nono brought into the concert hall, not only his individual thoughts, feelings, interrogations, but also called upon a social and political Other, which troubled the self-referentiality of avant-garde music and the self-contentment of its promoters and makers. In Nono's music, this pathos of decision, which affected the whole compositional process, was inseparable from his critical engagement or intervention within the life or the historical process lived by him as a man. For that very reason the category of "history" linked all these levels on which his activity took place: the musical composition was seen in itself as a historical process or as a development in time, which thus had to interact in real time with the appeal to history in general. History could not but be a constitutive element of the musical work simultaneously as political and cultural history, as personal history and as a history of a specific composition, as a development in time.

The way in which Nono and Stockhausen dealt respectively with the element of "space" makes still clearer the difference between their approaches. While Stockhausen used the element of space as a parameter, the organization of which depended - as with any other parameter - on the serial matrix or formula according to the principle of autopoiesis, Nono used space to develop techniques of montage as critical devices that might stimulate a meaning produced by the listener. Thus, in contrast with a musical development based on linearity and continuity, Nono aimed at a non-linear way of composing and listening, which had its correspondence in non-linear dramaturgy (in his operas), non-linear thinking, and a non-linear conception of history. Influenced by the philosophy of history of Walter Benjamin (1940), he dealt with the history of music in the some terms as he dealt with political and social history: not just as a self-moving development, but as a continuum that needed to be blasted open in order to offer a chance of liberation. However, this pre-supposed human decision and intervention could not be operated by what one could call metaphorically the autopoiesis of history. It is clear then that Nono did not aim at the ideal of the *opus perfectum ed absolutum,* which inspired many representative composers of the avant-garde scene and which the principle of autopoiesis ought to guarantee, but, on the contrary radicalized more and more in the "unfinished" the poetry of the fragment and montage (cf. Vieira de Carvalho 1996; 1999a; 1999b).

This digression on Nono's music has helped us to give still clearer contours to the thinking of composers such as Goeyvaerts and Stockhausen and to put in evidence the homologies between the theory of composition of the latter and Luhmann's theory of art. The elimination of "ideology" from the aesthetic experience is at stake in both cases. In the foreword to *Die Kunst der Gesellschaft* (1996), Luhmann speaks specifically of the necessity to write a new theory of society that leaves out the "ethics" of certain postulates (like happiness as a possibility for all human beings according to the ideal of solidarity). The "utopic components" of these postulations, he says, became at the end of the 20th century more and more evident (1996: 8). Similarly, new music, as certain composers of the "avant-garde" from the fifties conceived it, should leave out all external references, which were considered foreign to the sound material. The work of music should be a self-referential sound object. Behind this kind of "object centered", "reified communication" (Kaden 1984), which corresponds exactly to Luhmann's definition of the artist, the receiver and the critic of art as "observers" (respectively of the first, second and third orders), there is, therefore, the same rejection of any ethical or ideological intevention from the environment. The "contamination" of the work of music by an expressive intention on the part of the musician was also excluded. On the side of the receiver and of the critic, it was expected that they would recognize as observers in the sound object its structural qualities, and not that the musical experience would stimulate their own feelings or thoughts...

The homologies between Luhmann's theory of art and the theory of serial music from the early fifties seem in this way to be evident. They have in common a concept of self-reference and of autopoiesis that radically excludes a critical interaction both of science and art (as socio-communicative systems) with real life. In such an attempt, however, they cannot escape from ideology: thus, if the hegemonic ideas of the avant-garde scene of Darmstadt in the fifties corresponded to "the political act of depoliticizing music" (Bohlman 1993), one could also say that Luhmann's theory of art risks being understood as "the political act of depoliticizing art".

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ISSUES AND DISCUSSIONS

ANNOUNCEMENT

The editors of the *Journal of Sociocybernetics* are pleased to announce the initiation of a new rubric, "Issues and discussions", to be added to the "Articles", "Book Reviews" and "RC51 News" that up until now have made up the journal's contents.

"Issues and Disscussions" will publish your letters and commentaries (limited to a maximum of 1500 words, please). Are we overlooking something that you would like to see; or are we doing something right that you would like us to keep doing? Do you take issue with the theoretical or methodological approach or the findings of a published article?

We look forward to receiving your contributions. This is your forum and we all look forward to lively debates.

NEWSLETTER 11

1. LETTER OF THE PRESIDENT

Dear members of RC 51,

This newsletter informs you mainly about up-coming conferences, although other, maybe less conspicuous but not less important activities have been going on. Our website has grown and been up-dated, our "Journal of Sociocybernetics" has become available on the Internet, and also publications in the paper world are under way. A particular satisfaction for me is that we have received a Newsletter Grant from ISA. This reflects recognition of the efforts of our editors and our webmaster, whom I want to congratulate and thank very much for their dedicated work. Another reason to be satisfied is that we have enough ISA members of good standing to be allocated 16 sessions at the World Congress of Sociology.

All of this is good news, yet it is no justification to lean back comfortably expecting that "self-organization" will take care of things or that some board members will fix everything. There are also goals we wrote on our banners in Montreal that have not (yet) materialized. These we have to discuss seriously in Leon in order to be well prepared for the next World Congress. A vigorous and coordinated membership drive has not yet taken place; a substantial increase in young members, like students, or also of women has remained a good intention. Moreover, quantity, be it of members, papers or conferences, cannot be the only criterion of success. It even becomes meaningless, if quality does not keep pace.

Ensuring that quality keeps pace is not just a matter of all of our members becoming involved more actively in RC 51--proposing papers, proposing sessions, contributing to the organization of conferences and other activities--but also of being prepared to listen to each other and if necessary to revise, to rewrite, to improve, and even to discover entirely new ideas in the process of critical peer discussion which is the very essence of all science. With RC 51 having achieved so much and facing the challenge of the next World Congress of Sociology around the corner, it now appears to be the appropriate and necessary moment to call for a shift in our orientation and efforts towards more emphasis on the quality of our scientific products and achievements. This implies in particular a conscious evaluation of the topics we are dealing with.

Sociocybernetics, as systems science in sociology, is an abstract high-level approach to the entire field of the social sciences. If we look at the papers presented in our conferences we find we that have a very wide variety of topics. In a way, however, this also implies a certain dispersiveness. Teamwork beyond and outside our conferences has materialized very little so

far. Therefore it is necessary to take up the proposal made in Colimbari to establish a board position dedicated to promoting and coordinating research around a limited number of topics which are common to several of our members. This should not exclude other themes but provide at least a few focal points around which teamwork among our members could crystallize, synergy of our efforts develop, and progress in our scientific work become more tangible. In particular some of the Brisbane sessions could effectively serve as starting points for joint work and hopefully even joint research projects.

Bernd R. Hornung
President, RC51

2. MESSAGE FROM THE SECRETARY

Most of the balance of this issue of the Newsletter is taken up with the two major upcoming RC51 conferences: the Third International Conference on Sociocybernetics León, Mexico, 25 June-1 July 2001; and the 15th World Congress of Sociology, Brisbane, Australia, 8-13 July 2002. The complete program for the former (excepting the inevitable last-minute modifications) is presented below. I would call all members' special attention to the calls for papers for the individual sessions proposed for the Brisbane World Congress. RC51 belongs to a small group of Research Committees that, thanks to their membership levels, have been accorded the maximum number of sessions, sixteen. It would be unfortunate, indeed, if we were not able to fill these sessions. Please consider coming to Brisbane and presenting a paper at what is always an exciting and stimulating event.

The Newsletter now appears as a fixed rubric in each issue of the Journal of Sociocybernetics. As the official organ of the Research Committee on Sociocybernetics, *JoS* has now begun to take on its own unique personality. In particular, with this first issue of Volume 2, the graphic design has been improved and is now approaching standardization. Also, with this issue, *JoS* announces a new section (in addition to "Articles", "Book Reviews", and the "Newsletter") devoted to "Issues and Discussion", which will publish your letters and short commentaries (not to exceed 1500 words).

3. THIRD INTERNATIONAL CONFERENCE ON SOCIOCYBERNETICS

The program of the Third International Conference on Sociocybernetics, to be held June 25-July 1, 2001 in Leon, Guajanuato, Mexico has *now* been finalized. Most of the participants are coming from Europe, along with a few from the United States, while on Friday five Mexican participants will present their papers in sessions that will be chaired by two of our Spanish-speaking members. Our host will be Héctor Gómez Vargas, dean of the Department of the

Sciences of Man at the Universidad Iberoamericana in Leon. He will be assisted for the organization of our conference by Lourdes Hernandez and Robert Martinez.

3.1 Conference program

Monday, June 25
10.00-10.30: Welcome speeches by RC51 president Bernd Hornung, Mr. Sebastián Serra Martinez, Dean of the Universidad Ibero-Americana, and Mr. Arturo Mora Alba, Academic Director

10.30-11.00: Sesión Inagural (Inaugural Address) by Richard E. Lee, Secretary RC51

11.30-12.30: Morning session (chair: Bernd Hornung):

Dario Menanteau	The Possible Worlds of Hispanics in the United States Issues of System's Acceptance and Exclusion

14.00-17.30: Afternoon session (chair: Chaime Marcuello):

Vessela Misheva	The world of the ICT-user
Michael Paetau	Sustainability Networks and the Emergence of Knowledge

19.00: Dinner with all participants

Tuesday, June 26
10.00-12.30: Morning session (chair: Felix Geyer):

Mike Byron	Designing Simulations
Richard Lee	Cases of Classes, Instances of Processes: On Methodological Individualism, Systems and Historical Social Science

14.00-17.30: Afternoon session (chair: Bernard Scott):

Lucio Biggiero	Cybernetic View Of Decision Making
Czeslaw Mesjasz	Images of Organisation and Development of the Information Society: Moving into Metaphors
Kenneth D. Bailey	Insiders versus Outsiders: An Application of the Dichotomy Theory of Niklas Luhmann

21.00-23.00: Evening session, Business meeting (chair: Bernard Hornung)
Agenda will follow. Important points will be our membership drive, the Journal of Sociocybernetics, and the preparations for our sessions in at the World Congress of Sociology in Brisbane, July 8-13, 2002.

Wednesday, June 27
10.00-12.30: Morning session (chair: Richard Lee):

Bernd Hornung	Towards a sociology of process and information
Arne Kjellman	Sociocybernetics - the path to a science of becoming?

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14.00-17.30: Afternoon session (chair: Vessela Misheva):

Felix Geyer	The March of Selfreference
Bernard Scott	Learning Environments for Learning Communities A Report on the University for the Highlands and Islands Project
Evelyne Andreewsky and Geneviève Kouby	Complex collective responses as specular phenomena

21.00-23.00: Evening session (chair: Richard Lee)
An in-depth group discussion, "The subject-oriented approach to knowledge", moderated by Arne Kjellman

Thursday, June 28
10.00-12.30: Morning session (chair: Bernard Scott)

Diane Laflamme	The capacity to distinguish distinctions according to Niklas Luhmann
José Luis Piñuel and José I. García Lomas	Autopoiesis and Communication

14.00-17.30: Afternoon session (chair: Vessela Misheva):

Klaus Anders	Sex as indicator in the observation of social phenomena: Observation-Report - Influence
Chaime Marcuello	Evaluating the Social Efficiency of Non Profit Organizations: Towards a Sociocybernetic Model of Social Audit
Imtiaz Hussain	Morgue, Museum, or Mainstream Society? Indigenous Groups and Exit Options Under Democracy

21.00-23.00: Evening session: Democratization and Globalization (chair: Felix Geyer)
Assuming that the subject of the relationship between democratization and globalization will stimulate a sufficient amount of interest, a discussion about possible cooperation with Imtiaz Hussain of the Universidad Iberoamericana in Mexico City and others of the DEMOGLO (Democratization and Globalization group) will be held.

Friday, June 29
10.00-12.30: Morning session (chair: Chaime Marcuello):

Dolores G. de Landa	The New Community, New Order, New Civilization
Alejandro Guzmán	Work Team Management: The Challenge of an Endless Race in Organization Development

14.00-18.00: Afternoon session (chair: Dario Menanteau):

Ricardo M. Corona	Algorithmic Complexity in Real Financial Markets
Juan Soto Ramírez	The cognitive complexity a reflection center for the social psychology
Jesus Galindo	Ecologies and information and communication systems: Configurations, paths, situational matrixes and possibility Contexts--The social investIgation event
17.30-18.00	Farewell speech by prof. Héctor Gómez Vargas Conference summary by RC51 President, Bernd R. Hornung.

19.00 Farewell dinner for all participants. We will take here the advice of the organizers: "The international Mexican restaurant in question is named 'Andrea', located in one of Leon's best zones. It's very nice and elegant; it's located inside of a restored Hacienda and it looks nice at night. About the menu, there's lamb, poultry, pork, pastas, salads, soups among other things. They have both national and international wines, excellent desserts and the service is the best there can be."

Saturday, June 30
Excursion to San Miguel de Allende, free of charge, and offered by the University. Times to be announced.

4. 15TH WORLD CONGRESS OF SOCIOLOGY, BRISBANE, JULY 8-13, 2002

4.1 Calls for papers

The ISA allows us to organize 16 105-minute sessions at the World Congress. Moreover, in case we organize a session in collaboration with 2-4 other Research Committees, an extra time slot will be granted. The International Scientific Committee (consisting of President Bernd R. Hornung, Vice-President Vessela Misheva, Secretary Richard Lee, Brisbane Program Coordinator Bernard Scott and Honorary President Felix Geyer) has in the meantime approved 16 session proposals, which will soon be on our website as Calls for Papers and hopefully also at the ISA special website for Brisbane. The sessions are mentioned here in alphabetical order of (first) organizer. The definitive order, as well as the concrete time slots, will of course be determined much closer to the congress. Depending on the number of approved paper proposals received, some of these 16 sessions may either be cancelled, expanded to more than one time slot, or combined with others. Approval implies approval by the International Review Committee as well as the session organizer(s) concerned. Although no less than 16 sessions are mentioned here, two sessions will be held open for miscellaneous papers. This implies that most probably only 14 of these 16 sessions can actually be held, in view of the allotted maximum of 16 sessions. However, if we find 2-4 other Research Committees interested in co-

organizing one of these sessions (in which case the call will perhaps have to be formulated in a slightly different way), such sessions can be organized on top of the 16 sessions permitted by the ISA. Session organizers have been advised to start looking for suitable participants, both inside and outside of RC51. If you are interested in delivering a paper in one of the following sessions, please send a message to that effect to session coordinator Bernard Scott, bernard.scott@lews.uhi.ac.uk and to the session organizer of the session in which you would like to present your paper. You will then be asked to submit a 250-word abstract and a 1000-word abridged paper as soon as possible. The approved Calls for Papers now follow. You can also see them on the internet, in three different ways:
1. on our own website at http://www.unizar.es/sociocybernetics/brisbane.html as text;
2. at the same address as a downloadable .PDF file (more readable as the text can be enlarged) by clicking the icon at the top of that page:
3. on the ISA Brisbane website at http://www.ucm.es/info/isa/congress2002/rc/rc51.htm by clicking on "Call for Papers" for the sessions that interest you.

SESSION 1: SOCIOCYBERNETICS AND THE SOCIAL TRANSFORMATION OF HEALTH CARE

Session Organizer:
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A Cultural Change in Health Care: Online health services are expected to become a $370 billion business by the year 2004. The Internet is leading to the virtualization of healthcare delivery. All manners of health services are available over the Internet. The Internet has the potential to transform the organizational structure and the delivery of health services. The Internet is also changing the ways in which health care providers and their patients interact. These developments reflect a cultural change in health care. While these technological developments hold considerable promise, they raise a host of social and ethical issues that will be addressed in this session.

Licensure and Regulation: The very attribute of the Internet that holds the most promise, its global reach, challenges the way that health care professionals, services, and products have been traditionally licensed and regulated. States and national governments license physicians and other health care professionals and they approve pharmaceutical products. However, the Internet crosses state and national boundaries. Physicians who provide services over the Internet frequently reside in different states or even different countries. Internet commerce across national boundaries in prescription drugs has grown rapidly.

Potential Topics:
1. National versus multinational licensing of health professionals.
2. International regulation of pharmaceutical products and medical devices.

Health Information on the Internet: A growing number of consumers are seeking health-related information on the Web. On the one hand, the Internet provides access to a host of health and medical resources that can help consumers make informed decisions about their health care and to assume more responsibility for managing their own health. On the other hand, the information that is so readily available may be bewildering, incomplete, out of date, or false and misleading.
Potential Topics:
1. The digital divide: Inequities in use of and access to health information on the Internet.
2. Obtaining reliable health information on-line.
3. Fraud and quackery on the Web.

Conflicts of Interest: An additional problem with Web sites that provide health-related information is conflicts of interest. Drug companies are investing heavily in order to create a dominant presence on Web sites. A major concern is the blurring of commercial content and independent professional evaluation of drugs.
Potential Topics:
1. Conflicts of interest in direct advertising of health services and products.
2. Regulation of advertising of pharmaceutical products.

Privacy and Confidentiality: The value of electronic collection, storage, and transmission of personal health information is undisputed but, nevertheless, poses a dilemma. How can we provide the data required by the new forms of integrated health care delivery systems while protecting the personal privacy of the public? Information is used not only for patient care and financial reimbursement, but also for health education, research, social services, public health, litigation, and commercial purposes such as the development of new technology and marketing products and services.
Potential Topics:
1. Protection of the privacy and confidentiality of health information.
2. Problems in the sharing of health-related data among countries (e.g., the EU and the USA).

Changing Doctor-patient Relations: As more and more people use the Internet to gather information, many are addressing their own health needs. Some worry that patients who turn to Web sites for information may not consult their doctor when they have a serious health problem. In some instances, physicians feel threatened when patients confront them with information about alternative therapies that they have learned about using the Internet.
Potential Topics:
1. The social organization of on-line support groups.
2. Medicalization resulting from the Internet.
3. Provider-patient conflicts resulting from the availability of health information on-line.

4. Professional monopolization of health information (e.g., malpractice awards).

Session Organization: Papers are solicited that address any of the social and ethical issues outlined above. The session will consist of a panel discussion based on a number of short papers followed by questions and comments from the public at the end of the four papers.

SESSION 2: ART AND SOCIOCYBERNETICS - BOURDIEU VERSUS LUHMANN

Session Organizer:
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Theme: In his work "La Distinction - Critique Sociale du Jugement" ("The Distinction – A Social Critique of the Judgement of Taste") (1979) Pierre Bourdieu has implicitly responded to Kant's "Kritik der Urteilskraft" ("Critique of Judgement"). On the basis of wide empirical research he developed the concept of 'habitus' to explain how different aspects of the social life are linked with one another, including the art criticism, tastes and artistic communication. Instead of a universal or absolute point of view to judge a work of art, the aesthetical appreciation is presented as a matter of strategies of social distinction or (unconscious) affirmation of life styles. On the other hand, the concept of 'field' is used by Bourdieu to show that also artistic production emerges within specific conditions of social interaction, in which different social actors are always looking for more and more 'symbolic capital'. Although in Bourdieu's approach there is no explicit reference to sociocybernetics, it corresponds in fact to an attempt of thinking art, art communication, and art in society from a sociocybernetic point of view. Bourdieu's statement, according to which "the real is relational", could be mentioned in this respect.

The confrontation of this approach with that of Luhmann in "Die Kunst der Gesellschaft" ("The Art of Society") (1996), which is based on the concept of 'autopoiesis' and on the idea of a functional differentiation of the system 'art' within the communication system 'society' would be surely very helpful to develop the research on Art and Sociocybernetics. By postulating the self-reference and the 'autopoietic' reproduction of every system, including the system 'theory', Luhmann takes position against the viability of any critical orientation in social theory. In his theory of art he gets back in a way to Kant's approach, not only by recovering the idea of self-reference of art – in a functional opposition to 'science' or 'philosophy' ('pure reason') and 'politics' or 'ethics' ('practical reason') –, but also by constructing as the object of his sociological analysis only 'autonomous art' such as it has been developed since the bourgeois Enlightenment. On the contrary, Bourdieu, despite of taking into account aspects of a self-referential dynamics of art, implied in the categories of 'field' and

'habitus', puts into evidence the ideological character of 'autonomous art'.

This session will confront both positions within the framework of sociocybernetics and its recent theoretical developments. The alternative between a critical orientation of social theory also in matters of art (Bourdieu) and an orientation in which the system 'theory' refers only to itself, without aiming at any critical standpoint about society (Luhmann), will be specially at stake.

Submissions: Papers which compare Luhmann's and Bourdieu's theories of art, for instance critical approaches to Bourdieu – from Luhmann's point of view – or to Luhmann – from Bourdieu's point of view –, are specially welcome. Topics like 'autopoiesis', 'autonomy of art', 'art and utopia', 'art and critical theory', 'art and habitus', etc., might give rise to theoretical contributions on the theme of 'art and sociocybernetics', in which either Bourdieu, or Luhmann, or both would be discussed. Those interested in presenting a paper at this session should contact the organizer directly for further information.

Organization: The session will consist of short oral presentations followed by a discussion period. Papers, prepared with publication in view, must be completed and available for distribution in anticipation of the World Congress.

SESSION 3: CHAOS THEORY IN ECONOMICS AND SOCIAL SCIENCES

Session Organizer:
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Chaos theory emerged in the last quarter of the 20th century as the result of natural science's discoveries in the field of nonlinear dynamics. Nonlinear dynamics is the study of the temporal evolution of nonlinear systems, that is, systems exhibiting dynamic behavior such that relationships between variables are unstable. Changes in these relationships are subject to positive feedback, allowing amplification, breaking up existing structures and behavior and creating unexpected outcomes in the generation of new structures and behavior. Another characteristic of nonlinear systems is the poor relationship between cause and effect, small differences in the initial conditions may result in very large and unforeseeable effects.

As we know, the social realm is clearly nonlinear, instability and unpredictability are inherent attributes of social systems. Social systems have all characteristics of chaotic systems, since the requisites of discreteness, nonlinearity and feedback are attained. Social phenomena are exceedingly sensitive to initial conditions (large effects from small causes). Throughout the

1980's and 1990's chaos theory has been applied to a wide variety of social phenomena, ranging across different social science disciplines such as economics, political science, behavioral science, management, and even sociology.

The increasingly evident value of chaos theory in the social sciences, in its promise as an emerging means for enhancing both the methodological and theoretical foundations for exploring the complexity of social phenomena, is yet at its very beginning. Exploring this emergent potential value is the purpose of this proposed session. Contributions examining, exploring and applying chaos theory for the various social sciences disciplines are very welcome.

Session to be organized with short opening address and presentation of 4 papers, 25 minutes each, including discussion.

SESSION 4: MODELING THE SOCIAL WORLD BY USING COMPUTERS

Session Organizer:
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It is one of the latest advantages in science that we can use computers to support our intuition in describing and understanding the world. In the natural sciences it is the starting point for a completely new field of knowledge, which is called the science of complexity. By using computers we can grasp patterns we did not understand before because they were too complex. For social scientists, especially for those who try to integrate system science and cybernetics, it is a challenge to explore and develop their intuition of the complexity of the social world in this way. It is the purpose of this session to present a state of the art of this exploration.
Papers are invited which explore the possibility of advanced social sciences in a theoretical, empirical, methodological, and practical way. What theories can be made clearer by using advanced hard- and software? What empirical patterns of complexity can be better grasped by using computer models of social phenomena? How can processes of decision-making and planning in our society better be supported with knowledge of the complexity of social phenomena? Which methodology provides a solid scientific bridge between the intuition of social scientists, their theories, computer models, empirically observable patterns and the complexity of our world? Papers are preferred which have their basis in empirical research of social domains. However, papers which make transparent theoretical and methodological issues to support this research are also welcomed.

Depending on the number of papers and in consultation with the participants, the session will be organized as a full presentation of papers or a panel discussion on the basis of several short papers.

SESSION 5: NEW PARADIGMS FOR UNDERSTANDING SOCIETY

Session Organizer:
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The academic team which stands behind the session will be the sociocybernetic group of the University of Western Sydney, which includes: Dr V. Dimitrov, Prof. B. Hodge, Dr L. Kuhn and Dr R. Woog. The aim of the session is to attract research papers devoted to the search of new conceptual paradigms for understanding society, such as the paradigm of fuzziology (as a study of fuzziness inherent in human knowing), complexity science (as application of complexity and chaos theory in social research), soft computing (use of neuro-genetic models of social phenomena and processes), etc.

The search for new paradigms to understand society becomes vital in today's time of dramatic changes in the life of people and nature. The unpredictability of these changes and their extreme sensitivity to even the tiniest perturbations in the conditions under which they emerge, constantly injects uncertainty in human life and hence fuzziness in our knowledge about ourselves, nature and society. Fuzziology explores the fuzziness of human knowing, not in order to reduce or eliminate it (this is an impossible task!), but to understand, transcend its limitations, and transform it into new insights.
The ever-increasing dependence of the functioning of the society on the 'soft brains' of the computers and on the virtual reality emerging out of their interactions (networking) has a special priority in the list of today's social changes. A subtle destruction in the extremely complex organization of the computer brains and their relationships can lead to irreversible 'butterfly effects' producing social shocks of a very high magnitude (like ecological catastrophes, critical breakdowns in banking and communication, life-threatening failures in the functioning of industrial and military control systems, in the air traffic and cosmic experiments, etc.). Complexity science and chaos theory call for new frameworks for understanding society - frameworks centred in the study of the social manifestations of the emergent phenomena and far-from-equilibrium environments, of the criticality and self-organization, of the strange attractors and fractals, of the virtual realities and artificial life.

The application of soft computing - fuzzy logic, neural networks, evolutionary programming and genetic algorithms - to the modelling of social phenomena and processes opens new insights in understanding the evolving nature of the social dynamics in an inseparable *structural coupling* with the dynamics of the environment.

The session is open for papers in the above-mentioned domains, and also for research centred in the study of harmony in social life, in the exploration of its ecological and spiritual dimensions.

SESSION 6: GOAL-ORIENTATION, SELF-STEERING, AND SELF-ORGANIZATION

Session Organizer:
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A lot has been written about the classical divide between the factual and the normative, both outside sociology, e.g. in philosophy, and in sociology itself. A famous example is Max Weber's claim for a social science free of value judgements. This sharply contrasts with claims for an involved or emancipatory social science ranging from development studies to feminist research. A peculiar intermediate position is taken by Luhmann, professing a value-free neutral analytic social theory on the one side and "social enlightenment" on the other.

This session is not to resume the large discussions of sociological tradition. Instead, being aware of them, it is to investigate the different roles, functions, and conceptualizations of goals and values in sociocybernetic approaches building on recent developments in epistemology, theory building, and empirical research. One of these important developments is the recognition that normativity or axiology is a systematic part of sociocybernetics in the same way like theory, methodology, empirical research, and application. Another one is the recognition that normative aspects are inherent in basic concepts of systems theory like control, steering, self-steering, self-organization, and also autopoiesis.

A main objective will be to focus on these particular theoretical concepts and to analyze how they relate to more general - or more macro - aspects of goals and values in social systems and societies. The latter aspects include empirical value research as well as theoretical-normative systems approaches like orientation theory, as developed by Hartmut Bossel, and ethical-philosophical concepts as related to development and evolution. The interest of the session includes also how the systems concepts listed above relate to psychological - or more micro - phenomena, in particular the integration of emotionality into human action and behavior.

Moreover, it is of interest how sociocybernetic concepts and theories of normativity relate to the epistemological foundations of sociology, in particular constructivism, and to the autopoietic approaches to social and cognitive systems.

Papers presented for this session should not be purely empirical or descriptive. They should not deal with goals and values in general or just at a macro-level. They should make explicit reference to at least one of the theoretical concepts of control, steering, self-steering, self-organization or autopoiesis and deal with it in relation to the macro-level, micro-level or epistemological foundations. Ideally such theoretical analyses would refer to empirical phenomena in some subfield of sociology. Papers which do not deal with these theoretical concepts and the relationships outlined may be better placed in a session dealing with norms and values in a less restricted way. The session will consist of paper presentations with a following discussion.

SESSION 7: KNOWLEDGE AND (IN)EQUALITY - INEQUALITIES IN THE PRODUCTION, ACCESS, AND USE OF KNOWLEDGE

Session Organizer:
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Contemporary Western countries are described, inter alia, as information societies in which information and knowledge is the most influential resource for societal development. It is also argued, that information and knowledge play an important role in the development of developing countries. The importance of information and knowledge points to the necessity to explore the production, access, and use of knowledge and to analyse the consequences of inequalities in this area. Because of the complexity of this topic the scientific analysis requires an interdisciplinary approach for which sociocybernetic and system theorising might be helpful. The contributions for the session might deal with the following topics:

Theoretical views of knowledge and inequality

Inter-continental inequality of knowledge (North- and South-America, Europe, Africa, Asia)

Societal inequality of knowledge (consequences of and for the social structure, ethnic groups, gender, expert or lay status (e.g. in medicine))

Inter-generational inequality of knowledge (e.g. as related to the rights and the social position of children)

Inequality of knowledge and modern information technology

The session will consist of paper presentations with a following discussion.

SESSION 8: THE SUBJECT ORIENTED APPROACHES TO KNOWLEDGE AND LEARNING

Session Organizer:
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In the history of science there have been two approaches to man's judgement about the relation between the world and human experience; the *subjectivist's* and the *objectivist's* one. In the former one takes the cognitive subject and its experience as the point of departure, whereas in the second case one proceeds from a consideration of the "worldly things" themselves and a tacit postulation of their observer-independent existence in some presumed time-space continuum.

Today's prevailing realism, which has evolved in the natural sciences, mainly in the footprints of Galileo and Newton, is the objectivist's approach. In this situation, however, we are deeply caught in our capacity of being observers and therefore caught in an endless and fatal circularity – an issue addressed and expanded under the heading of second-order cybernetics.
Since the objectivist's approach neglects the influence of human feelings, it is almost useless dealing with cultural and ethical matters, especially in the psychic and social sciences – even if this situation has not yet been fully recognized. Here we must resort to facets of empiricism, constructivism and instrumentalism – i.e., the idea that the knowable world is mainly a construct in and of the human mind – the subjectivist's epistemology. In this view science and the *thinking subject* (cognizing agent) has no alternative but to construct what it knows on the basis of its own experience and refrain from the rush ontological postulate of a well-defined common and unitary "outside" world – the furniture of reality.

In this session papers addressing or expanding the issues mentioned above are welcome. We are here dealing with the ideas of the empiricists like Locke, Berkeley, Hume and Mill that have developed into knowledge domains called phenomenalism, cybernetics, constructivism, instrumentalism, hermeneutics, and modern feminism. We welcome papers addressing such and similar approaches to a clear-cut *subject-oriented approach* to balance the prevailing one-sided realistic/materialistic perspective. Quantum physics, cybernetics, the modern cognitive sciences, and learning theory have paved the way for such new approaches. For instance, life cannot be understood from the classical viewpoint – that was the point of departure for Maturana/Varela when developing autopoiesis. This session needs papers explaining why and how such subject-oriented frameworks are more adequate – not to say necessary – to handle the issues of a human culture, communication, and ethics on a well-defined scientific basis. This session needs papers that expand on the ideas mentioned and apply them in various

knowledge domains.

Papers that, for reasons other than comparison, take foothold in the classical realistic ontology for obvious reasons do not belong to this session.

SESSION 9: WORLD-SYSTEMS ANALYSIS IN THE TWENTY-FIRST CENTURY

Session Organizer:
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Theme: The basic premise of the world-systems perspective is that the relevant unit of analysis of the reality of human experience in terms of both action and constraints, that is of long-term, large-scale social change, is a historical system--simultaneously systemic in that it possesses continuities in its relational patterns and historical in that it comes into existence at a specific time and place, undergoes a spatio-temporal development which renders it at all times and places different, and eventually ceases to exist. The consequences of this initial assumption is, first, that the modern world, or "Modern World-System", must be analyzed as an open system that is unique in having expanded, as a necessity of its own reproduction, to cover the entire globe. Second, it must be analyzed simultaneously as both systemic and historical. And third, its elements, including the categories for its analysis, are not timeless and trans-historical, but were constituted in and through the development of its relational structure. Over the past quarter century, world-systems scholars have worked to develop theoretical strategies and methodological practices that avoid reification and reductionism and cut across disciplinary lines and cultural and ideological frontiers. Nonetheless, the simultaneously intellectual and political project of world-systems analysis still leaves much to be accomplished. Thus, the overall theme of this session will be the construction of a Historical Social Science for our times.

Submissions: In line with the theme of this session, papers that integrate the analytically differentiable but phenomenologically inseparable arenas of production and distribution (the economic), coercion and decision-making (the political) and culture and values (the social), whether theoretical, methodological or substantive in focus, will be especially welcome. Possible topic areas might include: Regimes of Accumulation, Commodity Chains, Externalities and Environmental Degradation, Antisystemic Movements, New Social Movements, The Interstate System, The Structures of Knowledge, "Cultural" Processes of the World-System. Those interested in presenting a paper at this session should contact the organizer directly for further information.

Organization: The session will consist of short oral presentations followed by a discussion period. Papers, prepared with publication in view, must be completed and available for distribution in anticipation of the World Congress.

SESSION 10: ETHICS OF TRANSITION AND TRANSITION OF ETHICS

Session Organizers:
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Ethics, as the prevailing opinion and practice of what is considered right or wrong, tends:
- to change over time, area, and circumstances,
- to be a crucial component of the basis of decision-making,
- hence to be an important common point of business and sociology scholars and practitioners,
- hence to require a systems approach, using an interdisciplinary co-operation in order to come closer to (requisite) holism.

Papers are invited which adress topics as follows (for example):
- sociological and business and other experience and investigation of ethics in e.g. Central and Eastern European countries, called countries / societies / economies in transition;
- idem of other areas in transition, of their own type, which are almost all areas of the entire World;
- impact of transition of ethics upon society and business, e.g. in terms of their modernization, catching up with the advanced world (on what criteria, if advancement can hardly be measured by technological changes and expressed in financial data, alone?)
- etc.

The session will last 105 minutes and may preferably take place as a panel discussion on the basis of several short papers.

SESSION 11: AXIOLOGICAL SYSTEMS THEORY: ITS APPLICATIONS TO ORGANIZATIONS

Session Organizer:
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Axiological Systems Theory (AST) looks for the re-humanization of Social Systems Theory, which means that we could be working on the basis of the following hypotheses.

1. The human being is the essential element of social systems.
2. The performance of social systems (mainly their outputs) have to be seen from the point of view of the stakeholders. That implies the "sociologisation" of the inquiring system.
3. Then, what becomes essential are not communications, actions, decisions, roles, interchanges, benefit of populations.
4. The only entity which satisfies these needs/desires/interests/expectations are "values". Hence, it is necessary to look for a universal pattern of values enabling us to make valid comparisons between different types of social systems.
5. Many scholars sustain that it is not possible to find such a universal list of values, since all individuals are different and each one has different needs, desires, etc. This is nevertheless not true: a universal model of human needs already exists. This is the UNIVERSAL DECLARATION OF HUMAN RIGHTS, (UNO 1948), where most countries in the world adopted the same values to be pursued for all populations on the earth. On this basis and other theoretical models (Maslow, Deutsch, van Gigch, Terleckyj. etc.), the following Referential Pattern of Values is adopted:
1. Health, 2. Wealth, 3. Security, 4. Knowledge, 5. Freedom, 6. Justice, 7. Conservation Of Nature, 8. Quality Of Activities, and 9. Moral Prestige.
6. Each one of these 9 values can be validly operationalized and quantified through empirical indicators (Lazarsfeld) taking into account both, objective (statistical facts) and subjective (opinions of stakeholders) outputs. Thus, it is possible to get the total OUTPUTS.
7. The same operation can be made with the resources used to get the INPUTS.
8. Therefore, the performance (T) of social systems can be calculated and compared in time and space, through the algoritm: T=Y/X=Outpus/Inputs.
9. As a consequence of these calculations, a series of operations and concepts such as *Social Change, Social Progress, Social Regression, Deviation Analysis, Socialization, Ethical Behavior, Applied Critical Theory, Organizational Diagnosis, Explanatory Analysis, Cybernetic Analysis, Information Systems Design, Decision-Making Process*, ETC., can be worked out.

Therefore, papers should deal with the possibilities, perspectives and problems for knowing

and calculating the overall performance of social systems as one of the applications of AST. Criticisms to these possibilities will be especially welcome. Needless to say that all epistemological, theoretical and methodological approaches to the study of society should be considered as mere complements of each other. As the Session is 105 minutes long, only FOUR papers will be selected for official presentation during the Congress. Nevertheless, high standard papers can be considered for a future publication. Those interested in presenting a paper should send, as soon as possible, a summary explaining the idea they want to develop or apply in relation with this axiological approach to systems.

SESSION 12: THE PERTINENCE OF LUHMANN'S THEORY FOR SOCIOLOGICAL ANALYSIS

Session Organizer:
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This session is designed to explore and enrich Luhmann's theoretical approach with respect to sociological analysis. It is open to people who embrace his perspective and wish to extend it in different ways. We are especially interested in papers that would underline how his theory explains salient issues in contemporary society, identifies key questions and offers ways of dealing with those issues that classical sociological theory usually treats in traditional ways. Papers that would offer theoretical modifications that would deepen Luhmann's contribution to sociological theory would also be welcome. We start from the position that Luhmann's theory is the most exciting and powerful analytical approach and so are interested in seeing how the theory can address those issues which most seem to concern people today: identity, democracy, globalization, inequality, risk, irony, to name but a few, but also theoretical debates in sociology. We ask that papers be as short and precise as possible in order to maximize time for debate.

We would also hope to organize two sessions on this theme in order to engage in meaningful debate and develop an international "Luhmann network" that would provide an ongoing framework for further collaboration and research. Hopefully, these sessions will result in an eventual publication.

SESSION 13: THE IMPACT OF ICT DEVELOPMENTS ON EDUCATIONAL INSTITUTIONS, BUSINESS ORGANISATIONS AND COMMUNITIES

Session Organizer:
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Developments in information and communications technology (ICT) are transforming educational institutions, business organisations and communities at local, national and international level in many novel and often overlapping ways. Indeed, new kinds of institution, organisation and community are coming into being under such headings as "the learning institution", "the learning organisation" and "the learning community". In the spirit of the founders of both cybernetics and systems theory, the session aims to develop syntheses and synergies across both particular disciplinary approaches and particular domains of empirical investigation. Papers are invited that:
develop sociocybernetic and system theoretic formulations of how to conceptualise and understand these transformations and emergent developments;
present relevant empirical studies of institutional, organisational or community change;
describe particular developments and applications of ICT (e.g., in computer-mediated communication, learning environments and knowledge management) and associated research and evaluation studies.

The 105-minute session will consist of the presentation of four papers with time for discussion.

SESSION 14: MODELING SOCIETY-ENVIRONMENT INTERACTIONS

Session Organizer:
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As part of the program of the ISA-World Congress on Sociology, July 2002 in Brisbane, a session on Modeling Society-Environment-Interactions will take place, with the aim to bring together researchers from different sub-disciplines within social sciences who are interested in a conceptual, analytical, and operational representation and simulation of the various linkages

and interrelationships between processes in the anthroposphere and the environment. In human ecology, global change research, socionics, but also in the core disciplines of social sciences, recent developments can be found using modeling techniques and computer simulation for theory building, hypotheses generation and validation. Besides more "traditional" modeling paradigms - like those applying system dynamics or hierarchical systems theory - agent-based models and concepts of self-organization provide nowadays alternatives for model building and evaluation. In the session some of these approaches are to be introduced and discussed with respect to relevance, problem solution capacity, and future perspectives.

Aim of the session will be to look for possibilities of applying these modeling approaches in fields of practical societal relevance, i.e. sustainable development, social-ecological transformations and social metabolism. In this context we are interested in approaches which deal more or less explicitly with structural aspects of socio-technical, socio-ecological, socio-cultural etc. systems and with the resulting (social or energetic-material) dynamics. Hence, statistical modeling approaches do not lie in the heart of our concern. Papers presented should also address future perspectives of the approaches discussed, especially looking for a better understanding of society-environment interrelationships and their mutual influences.

One or two sessions are planned according to the number of papers accepted under the general headline. It is intended have paper presentations of around 20 minutes each within the session(s) but if possible we try to build thematic blocks with papers addressing a common issue or problem treatment.

SESSION 15: LES AQUIS DE LA SYSTÉMIQUE ET SOCIOCYBERNÉTIQUE DANS LE MONDE FRANCOPHONE
(Achievements of Systems Science and Sociocybernetics in the French Speaking World)

Session Organizers/Responsables:
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Dans le but de favoriser le dialogue et les échanges entre les chercheurs francophones et anglophones dont les travaux portent sur la systémique et la sociocybernétique, la présente session offre un forum aux chercheurs voulant présenter leur exposé en français.

Nous souhaitons que les contributions proposées fassent connaître la teneur de la recherche d'expression française en théorie des systèmes, ses résultats les plus marquants pour le développement de la sociocybernétique et les récentes avancées dans ce domaine. Les exposés peuvent porter sur des aspects théoriques, méthodologiques, normatifs, ou encore faire état de recherches empiriques ou de démarches d'application, tout en demeurant axés sur des questions ayant une incidence sur le développement de la sociocybernétique. Les conférenciers peuvent aussi, à partir de leur champ d'étude respectif, proposer des liens avec les sciences sociales et la sociologie d'orientation systémique.

Il serait intéressant que certaines des contributions résument l'état actuel de la recherche d'expression française en ciblant des secteurs précis de la sociocybernétique et de la sociologie, ou encore abordent les présents développements de la sociocybernétique et de la sociologie dans une région du monde, par exemple l'Afrique francophone. On pourra aussi examiner dans quelle mesure la recherche en théorie des systèmes et en sociocybernétique dans les pays francophones évolue selon des tendances qui lui sont propres, mettre en relief ce qui la caractérise et éclairer les raisons qui expliquent l'état actuel des choses. Considérant que la théorie des systèmes se veut une démarche scientifique unifiée et universelle, on voudra alors savoir si les différences culturelles invoquées, le cas échéant, contribuent à l'émergence d'une culture scientifique et d'une approche de la sociocybernétique qui seraient différentes dans le monde francophone et dans le monde anglophone.

Translation:
Achievements of Systems Science and Sociocybernetics in the French Speaking World

This session is intended to promote the dialogue and exchange between the French and the English speaking systems and cybernetics communities by providing a forum for contributions to sociocybernetics in French.

The session aims at identifying within the French-speaking systems community findings and research problems crucial to the further development of sociocybernetics and to present the current state-of-the-art. In this respect contributions are welcome from all fields, i.e. theory, methodology, normativity, application, and empirical research, as long as they point to issues important for the future development of sociocybernetics. Apart from this, they may relate such issues to systems sociology in the respective field.

Accepted will be also state-of-the-art reports either summarizing a particular field of sociocybernetics and sociology within the French speaking community or the state of sociocybernetics and sociology within a region, like e.g. French speaking Africa. Of interest are also investigations to what extent there is indeed a particular kind of systems science and

sociocybernetics in French speaking countries and what are in fact the differences and reasons for this. Such papers may in particular take into consideration that systems science claims to be unified and universal and try to relate this claim to possible cultural differences which might have given rise to different scientific approaches and cultures in the francophone and anglophone systems and cybernetics communities.

The session is expected to take the form of paper presentations with a following discussion.

SESSION 16: UN ENFOQUE SOCIOCIBERNÉTICO AL LOS RETOS DEL SIGLO XXI
(A Sociocybernetic Approach to the Challenges of the 21st Century)

Session Organizers:
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La posibilidad de anticipar y pronosticar escenarios sociales, económicos y políticos constituye una importante tarea de las ciencias sociales, en general, y de la sociología, en particular. En relación a esta función, el enfoque sociocibernético permite delinear los procesos que demarcan la gestión del presente, en un esfuerzo para crear rumbos y modelos de sistemas sociales que influyan en el diseño del futuro. El enfoque sociocibernético acepta el principio de que los procesos de cambio social y de innovación no son frutos del azar o de la casualidad. Los sistemas sociales evolucionan articulando la voluntad y posibilidades de sus sujetos, en un repertorio de mundos posibles.

Esta sesión tratará sobre la gestión de los sistemas sociales y el diseño de nuevos horizontes de acción y legitimación de la vida social, política y económica: la creación de mundos posibles. Para ello, se considerarán tanto los elementos normativos como el análisis de las consecuencias de hechos reales. Por eso, los trabajos para esta sesión podrán proporcionar una definición de los principios que legitimen acciones futuras, o bien los efectos de determinadas acciones ya en proceso. Asimismo, las contribuciones que traten de los problemas epistemológicos y metodológicos serán bien recibidas.

La sesión proporcionará un foro abierto para el intercambio de ideas, la discusión y divulgación de investigaciones realizadas en el ámbito hispanohablante. Se pondrá énfasis en explorar las contribuciones de la sociocibernética y el enfoque sistémico de las ciencias sociales. Se dará especial atención a la participación de investigadores implicados en la reflexión sobre los retos del siglo XXI, especialmente de los países latinoamericanos.

Los trabajos de esta sesión incluirán una amplia variedad de temas dentro del campo de la sociocibernética y teoría de sistemas. Los trabajos pueden tener su base en investigaciones empíricas, simulaciones o estudios realizados en ámbitos microsociales o macrosociales, discusión teórica o metodológica. Todos los casos deberán hacer referencia explícita al diseño del futuro y los procesos de gestión del presente que incidan en la transformación, re-formulación, control, organización e innovación de sistemas sociales

Esta sesión de 105 minutos de duración, proporcionará igual tiempo a cada uno de los cinco trabajos seleccionados y dejará espacio para el debate y discusión entre los participantes.

Translation:
A Sociocybernetic Approach to the Challenges of the 21st Century

The possibility of anticipating the future and forecasting viable social, economic, and political scenarios constitutes an important task of the social sciences in general, and sociology in particular. In relation to this function, a sociocybernetic approach allows delineating the processes shaping the present, in an effort to create guidelines and models of social systems with which to influence the design of the future. The sociocybernetic approach accepts the principle that processes of social change and innovation are not random events. Social systems evolve articulating individuals' wills and their possibilities into a repertory of possible worlds.

This session will deal with the performance of social systems, as well as the design of new horizons of action and legitimization of social, political and economic life: the creation of possible worlds. The study of normative elements and the analysis of actual consequences will be considered. Thus, the papers for this session may provide a definition of legitimizing principles of future actions, or they may deal with the effects of specific actions already in process. Also, contributions focusing on epistemological and methodological problems will be welcome.

The session will provide an open forum for the exchange of ideas, and the discussion and diffusion of research, conducted in Spanish-speaking countries. Emphasis will be given to exploring the contributions of sociocybernetics and social systems perspectives. Special attention will be given to scholars studying and reflecting on the challenges of the 21st century, especially concerning Latin American countries.

Papers to be presented in this session will include a large variety of themes within the realm of

sociocybernetic and systems theory. The papers can be based on empirical research, simulation studies at the micro or macro social levels, theoretical discussions, or methodological work. All papers must make explicit reference to social design for the future, and current processes which may influence the transformation, reformation, control, organization, and innovation of social systems.

This session, of 105 minutes, will provide equal time for each of the five selected papers. Time will be allocated for the debate of ideas and discussion among participants

4.2 Deadlines

January 1, 2002: ISA deadline for submitting abstracts of accepted papers to the Congress Secretariat. All programme participants (paper givers, session organizers, chairs, discussants, etc.) must register before January 1, 2002. Otherwise their names will NOT appear in the Programme Book and abstracts of their papers will NOT be published by the ISA on the internet.

December 1, 2001: Our ultimate deadline for receipt of 250-word abstracts.

December 1, 2001: Participants will be notified latest by December 1, or as much earlier as possible, whether or not their paper proposal has been approved.

September 30, 2001: Ultimate deadline for receipt of 500-1000 word detailed abstracts.

You will realize these deadlines are mutually dependent. We assume that nobody wants to pay a higher congress fee after January 1, while not seeing one's abstract published or not seeing one's name in the World Congress program book also do not seem to be attractive options. The congress fees are dependent on country and on whether or not you are an ISA member. For example, in category A (the "rich countries"), ISA members pay a US$ 525 for pre-registration and a US$ 600 for registration, the non-ISA members pay a US$ 625 and a US$ 700 respectively.

Our program coordinator Bernard Scott will need the month of December to arrange with session organizers in which session approved papers will be presented. Of course you may indicate your preference for one of the 16 sessions mentioned above, but placement of your paper in the session of your choice is not completely certain, and obviously also depends on the approval of the session organizer concerned. Since we count up to two months for the approval procedure, which thus should be finished latest by December 1, the inevitable deadline for submission of your 500-1000 word detailed abstract is September 30. You only need to send your 250-word abstract if and when your detailed abstract has been approved by the Review Committee, but anyhow by December 1, 2001. The approved abstracts will be published on our website, and will most probably also be printed in an abstract booklet which will be distributed

during our Brisbane sessions, also to non-RC51 members who happen to visit our sessions.

If it is absolutely impossible for you to keep to these deadlines, and if you can send your abridged paper only towards the end of the year, or even later, you will obviously have to pay a higher congress fee, and will not be mentioned in the World Congres Progam book, nor will your abstract be published by the ISA. Moreover, we then cannot guarantee we will find a place for the presentation of your paper in one of our sessions, though we will do our best to review your abridged paper as soon as soon as possible, and – if approved - will try to accommodate your paper in that case.

5. NATO ADVANCED NETWORKING WORKSHOP

Telemedicine in Central Asia
Applications in Emergency Medicine
Tashkent, Uzbekistan, April 2-4, 2001

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1. Goals and Objectives

From April 2 to 4, 2001, a NATO Advanced Networking Workshop was held in Tashkent, Uzbekistan, about "Telemedicine in Central Asia - Applications in Emergency Medicine". This workshop, sponsored by the NATO Scientific Affairs Division under its Networking Infrastructure Programme, was co-organized by the Tashkent Institute of Cybernetics of the Academy of Sciences of Uzbekistan and the Ronald Reagan Institute of Emergency Medicine of George Washington University, Washington D.C., USA. It was co-hosted in Tashkent by the State Committee of Science and Technology and the Ministry of Health of Uzbekistan.

The conference, which brought together specialists from a dozen different countries as well as a large audience from Uzbekistan including health professionals and students, addressed the use of telemedicine and distance-based health education in the development of emergency medical care in Central Asia.

The goal of this NATO Advanced Workshop was to exchange and to share experience and to inform about telemedicine applications and distance learning. It intended to demonstrate how such advanced applications of information technology can be used for the development of emergency medicine in Central Asia. The conference was designed to elicit ideas and expertise in order to encourage new developments. This was to be achieved by a combination of lectures, teleconferences with experts in distant sites like the US, the UK, Norway, and WHO in Geneva with real-time interaction, and small group discussions. Simultaneous translation was provided for all the sessions.

2. Strategic Importance for Health Care in Central Asia

The strategic importance of this conference in the context of developing an IT networking infrastructure in Central Asia resulted from the fact that health care is a major candidate for improvement in any vision of the ”information highways” and ”information societes” that are currently being discussed. One of the largest and fastest growing segments of the health care technology industry is health information technology. The expected revenue by the year 2001 is 20 billion $ US. Telemedicine currently accounts for only a small part of this market but is expanding rapidly. In the United States more than 60% of federal telemedicine projects were initiated in the last two years. The concept of telemedicine captures much of what is developing in terms of technology implementations, especially if it is combined with the growth of the Internet and World Wide Web (WWW). It is predicted that WWW will become the most important communication medium of any future information society. If the development of such a society is to be on a global scale it should not be allowed to develop in ad hoc manner. Telemedicine is the interactive mutlimedial communication between health care providers and their partners regardless of geographic distance.

WHO recommends considering at least four aspects of health care where telemedicine could play role within national health policies:

Quality and Efficiency of Health Care Services.
Telemedicine could provide an important contribution to ensuring the availability of accurate and up-to-date medical information when and where needed.

Reinforcement of the National Health Care Structure:
Telemedicine could help to improve linkages and cooperation between rural and remote district hospitals and the main national hospitals which are hospitals of maximal care disposing of advanced medical technology and high expertise in virtually all fields of medicine.

Training and Education:
Telemedicine services could assist in providing training and education to health-care professionals in rural and remote areas.

Administration:
Telemedicine could support the administrative tasks involved in implementing new national health policies, which currently is a considerable problem in many developing countries.

Uzbekistan is the only country of Central Asia that has a concept for the development of telemedicine, which was designed already in 1999. A first important step towards raising awareness and bringing together representatives both from the telecom and health care sectors was this NATO Advanced Networking Workshop.

3. Workshop Activities

The lectures took place in the auditorium of the Tashkent Surgery Center in the mornings and early afternoons. Introductory speeches and a first series of lectures focused on health care in Central Asia, with a specific emphasis on emergency medicine. A general, introductory presentation dealing with the definition of telemedicine, organizational issues, and basic equipment and training required was followed by presentations of current telemedicine applications. Examples ranged from simple, but well-organized telephone systems offering the possibility of consultation to distant ships at sea, to the sophisticated transfer of radiological images from remote sites in Kazakhstan to expert radiologists in capital cities. Lectures about the training of physicians in emergency medicine provided a definition of emergency medicine and showed the value of this specialty for providing acute primary care in developing countries. It was demonstrated to the participants of the workshop how to access the vast wealth of materials on the Internet to inform and educate themselves about the topics of emergency medicine at little or no cost.
Small group sessions were conducted in the afternoon of each day to discuss the contents of the previous lectures, the applicability in the participants' local areas, and to brainstorm about possible future projects. General questions had been prepared in advance to guide the discussions. The first day these concentrated on issues of training and education, the second day on telemedicine applications, and on ideas for future projects the third day. The objective of the first day was to specify appropriate educational techniques and standards for both hospital and ambulance personnel (or also pre-hospital personnel). On the second day the small group discussions were directed to the needs that exist for telemedicine applications and to the resources and organizational infrastructure required. In the final small group session participants spoke about what might be the next steps to establish telemedicine applications and training in emergency medicine in Central Asia.

A very special component of the conference was the use of real-time teleconferencing via the World Bank satellite. In the late afternoons of the first and second day, participants were taken by bus from the Surgery Center to the office of the World Bank. There videoconference links were established between Tashkent and Geneva, London or Washington with television cameras and monitors on both sides. In this way the remote speakers could see and speak to the workshop participants in Tashkent in real-time. This feature of the conference served two purposes. First, it allowed expert consultants to present telemedicine applications and to answer questions without the costs and interruption of work travel usually involves. Second, it illustrated a powerful tool for remote synchronous learning.

4. Results and Conclusions

Among the participants of the workshop and in particular during the small group sessions a number of key issues was discussed. On the basis of these discussions and reactions to the presentations the following conclusions can be formulated:

In the field of emergency medicine:

It is worthwhile to develop emergency medicine in Central Asia.
Primary care and emergency medicine have to be developed simultaneously in Central Asia.
The use of distance learning promises to increase educational resources, to better achieve educational and training goals, and to increase informational resources in Central Asia.
Health care providers in pre-hospital and hospital settings should learn treatment protocols for emergency cases. Such courses should be taught at specialized training centers such as those created by AIHA.
Personnel of emergency medical services should have the opportunity to rotate through countries with well-established emergency systems.
Dispatchers in emergency services should be trained in basic triage skills using standardized questions.as well as in providing verbal first aid and in coaching callers.
The public should have general access to CPR education

In the field of telemedicine applications:

Specialists in information technology, medicine, and public affairs should be brought together for establishing working groups that will prepare telemedicine initiatives.
All hospitals and all health care providers in rural and remote areas need telephone connections providing the possibility to consult tertiary care specialists without incurring large long-distance phone-bills.
All hospitals need Internet access.
Many physicians have access to the Internet but do not know how to extract medical knowledge from web-sites. Training of medical personnel in the use of information technology is crucial.

At first, simple pilot projects should be developed, concerning e.g. only telphone consultation services. In a second step larger projects might follow, such as remote radiology, dermatology, cardiology etc. using small digital cameras.

By the NATO Advanced Networking Workshop on Telemedicine in Central Asia a new understanding and appreciation of the value of telemedicine and emergency medicine was developed. The greatest value of the workshop, however, was the establishment of working relations among the participants and speakers. This networking between health care and IT professionals is the first step in advancing health information technology in Central Asia.

6. UPCOMING CONFERENCES

International Conference of the System Dynamics Society. Atlanta, Georgia, USA, July 23-27, 2001. For information contact Roberta L. Spencer at system.dynamics@albany.edu or see

http://www.albany.edu/cpr/sds/sdconf2001/

The 3rd Symposium on Systems Research in the Arts: Music, Environmental Design, and the Choreography of Space, Baden-Baden, Germany, July 30 - August 4, 2001.
See: http://www.shorter.edu/jrhodes/bb2001/symp2001.htm. This conference addresses the study of systems within the scope of traditional arts-related theory, or the application of general systems methodologies to the analysis of music, architecture, interior design, dance, theatre, and the visual arts. Abstracts due March 25, 2001. Contact: Jim Rhodes

The 13th International Conference on Systems Research, Informatics, and Cybernetics Baden-Baden, Germany, July 30 - August 4, 2001.
See: http://www.iias.edu/frameset_start_inters_ann.html. This conference deals with software engineering, artificial intelligence, cooperative systems, multi-media, environmental systems and social science.

First International Summer School of Systems Design at the recently founded University of Italian Switzerland (USI) in Lugano. No date given. Information: http://www.lu.unisi.ch/lss .

11th Annual International Conference, The Society For Chaos Theory in Psychology & Life Sciences, Madison, WI, USA, August 3-6, 2001. See www.societyforchaostheory.org

IVA2001, Third International Workshop on INTELLIGENT VIRTUAL AGENTS, September 10-11, 2001, Madrid, Spain. See http://bermudas.ls.fi.upm.es/~iva01/

Semiosis Evolution Energy International Conference, University of Toronto, October 6, 7, 8 of 2001. http://www.library.utoronto.ca/see

Reflexive Processes and Control, The Institute of Psychology, Russian Academy of Sciences, Moscow, October 8-10, 2001. See: http://webcenter.ru/~lepsky/

INTERNET RESEARCH 2.0: INTERconnections, The Second International Conference of the Association of Internet Researchers, October 10-14, 2001, University of Minnesota, Minneapolis-St.Paul Minnesota, USA. See: http://www.cddc.vt.edu/aoir and http://aoir.org .

Bertalanffy Anniversary Conference 2001: UNITY THROUGH DIVERSITY, International Conference on Systems Thinking Globally Concerned, November 1-4, 2001, University of Vienna and Vienna University of Technology. See: <http://www.bertalanffy.org/index.shtml>
At the same time you are invited to take part in the conversazione before the conference via sending the text "subscribe bertalanffy-list" to lists@igw.tuwien.ac.at and to visit the website http://www.bertalanffy.org/discus where all the previous and following contributions for keeping up the debate are included.

The Second International Conference on Systems Biology (ICSB2001), Nov 5 - 7, 2001,

California Institute of Technology, Pasadena, USA, http://www.systems-biology.org .

HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES, HICSS-35 January 7-10, 2002, Hilton Waikoloa Village, Big Island, Hawaii, January 7-10. 2002. See http://www.hicss.hawaii.edu/HICSS_35/apahome35.htm

EMCSR 2002, April 2 - 5, 2002, University of Vienna, organized by the Austrian Society for Cybernetic Studies in cooperation with Dept.of Medical Cybernetics and Artificial Intelligence, Univ.of Vienna and International Federation for Systems Research

International Congress: Causation And Explanation In The Natural And Social Sciences, Ghent University - Belgium, 15-18 May 2002. See http://Logica.Rug.Ac.Be/Censs2002/.
Systems Theory and Practice in the Knowledge Age, an international conference of the United Kingdom Systems Society at the University of York, July 7 – 10, 2002.

6. PUBLICATIONS

Volume 4, Issue 2 of the Journal of Artificial Societies and Social Simulation (JASSS) deals with "Agent-based modelling, game theory and natural resource management issues" and is available at http://jasss.soc.surrey.ac.uk/4/2/contents.html

Moreover, JASS, the Journal of Applied Systems Studies (not to be confused with JASSS!) has a special issue on “Industrial Applications of Holonic and Multi-Agent Systems”, with Vladimír Mařík and Michal Pěchouček as guest editors. It is freely downloadable at <http://www.unipi.gr/jass/arxi.htm>.

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