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MEETING REPORT: THE 1989 SYMPOSIUM AND PAPER SESSIONS ON BRIDGING THE GAP BETWEEN THE NATURAL AND HUMAN SCIENCES IS IT POSSIBLE? IS IT DESIRABLE?

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This brief report covers the 3 symposium presentations, 11 paper session presentations, and one workshop on the topic of similarities and dissimilarities between natural and social systems which were delivered in Edinburgh, Scotland at the ISSS 35th International Conference. It also outlines the 12 papers and 4 abstracts published in Volume III of the Proceedings of the Conference (Ledington, Ed.) pages 142 to 223. Both practicing natural scientists and social scientists were present. In addition, all of the major domains of systems science, general systems theory, systems theory, systems methodology, and systems application/design were represented.

Attendance at these sessions varied from as many as ninety at the opening session to less than a dozen at some of the paper sessions, presumably due to participants electing to attend other sessions or participants who chose to present multiple papers at different sessions. The conference organizers noted this same level of flux in other sessions and will be focusing on measures to ameliorate this undesirable characteristic of our meetings in the future to enhance, if possible, the health of individual sessions without unduly effecting the freedom of movement of attendee's.

Whatever the number of participants, the debates comparing natural and social systems were invariably enthusiastic and interesting, and the questions probing. Indeed, the organizers of the session were amazed at the creative diversity of approaches attracted by the simple call for papers partially reproduced below. Although originally conceived as a one-time look at a *de facto* "separation" that constituted an embarrassing problem and major obstacle to a society dedicated to integrating theories and models, it became clear that the participants wanted to do something significant over a longer period of time to overcome the "separation" between natural systems scientists and social systems practitioners. Before revealing the practical and creative suggestions the final workshop participants suggested that the ISSS sponsor, let me introduce the problem and the discussions that preceded the workshop.

The background statement to which participants responded introduced the separation between natural systems science and social systems science in its historical framework. The gap between the natural sciences and human societies was portrayed as just one of several chasms characteristic of the manner in which past generations of humans conceived of their world. For example, for centuries, living and non-living systems were thought to be fundamentally different and forever separate in terms of underlying processes. Increasingly, the results from studies in new fields such as biochemistry, biophysics, origin of life research, cosmochemistry, information theory, study of regulatory mechanisms, fractals and chaos theory, and non-linear dynamics, as well as work on self-organization, indicate that both living and non-living systems have many common underlying processes with the former, naturally giving rise to the latter in certain situations. Still, exaggerated separation of the two cohorts of systems persists, even to the extent of an unexamined belief in many.

Worse, still, is the long established separation of natural from human systems. Due to slower progress at this interface, few interdisciplinary specialties have yet emerged to bridge the gap, if,indeed, it will ever be bridged. The neophyte field of sociobiology, proposed as an analogue to interface fields like biochemistry and biophysics (Wilson, 1975; Wilson and Lumsden, 1981 and 1983) has been severely criticized by conventional workers on both sides of the areas that sociobiology might bridge (e.g. Caplan, 1978; Lewontin et. al., 1984). These are usually specialists in established classical fields like evolutionary biology and sociology.

The particular chasm between natural and social systems that fields like sociobiology might bridge is of special importance to workers who work on or hope for a unified systems science because it effectively divides and isolates its results, applications, and benefites. Some claim that nothing known about natural systems will ever be applicable to human systems, while others suggest natural systems organization be used to aid human systems design. Which position is correct? Or, in which cases is one correct and not the other? Could they both be simultaneously correct? On what basis or evidence can such conclusions be justified? Or in the words of a provocative question posed by one of the participants in this session (Donald McNeil)..."who benefits from the gap between natural and social systems, and is this imagined or real "benefit" responsible for persistence of the "gap?"

Analysis of past systems conferences indicates that human systems specialists primarily meet only with each other on topics mostly limited to their domain, and the natural systems specialists do likewise. In debates, despite their claims to be general theorists in this society, practitioners of each area reveal the long-standing, usually unexamined, and quite conventional or classical prejudices of the areas in which they were trained. Even the younger systems-trained specialists have often graduated from a systems education program skewed in the direction of human applications or systems methodology or natural systems science and retain rather mutually exclusive perspectives.

This paper series tried to examine the chasm between natural and social systems to provide answers to these questions and to suggest possible lines of research on the issue for the future. What could be done about the differing standards and protocols of investigation? What in systems approaches might bridge the gap? Are there any underlying common structures and processes between these two domains? What limits cross-level applications? In what do the types of systems clearly differ according to the viewpoints of both specialists? What practical activities could the professional societies undertake to help social and natural scientists communicate to promote systems studies and to help broaden systems education programs if these goals are deemed feasible and desirable? Is there enough depth of material in this "bridging" problem to make organization of a ISSS-S.I.G. to continue work on the interface a worthwhile and beneficial development for the field and for the society?

Although the approaches to the above problem statement as reflected in the papers and platform presentations were quite diverse, they appeared to fall into four major categories, each represented here by three to five papers.

The opening symposium presentation attempted to approach the chasm from the broadest possible perspective in order to serve as a background for the debate that followed. First, Troncale defined what he meant by natural systems (all physical, astronomical, atomic, chemical, geological, biological, and mathematical relationships that would remain if man had never existed) and social systems (humans and all their hierarchical aggregates and artifacts including human-produced information systems and designed systems, even if physical). [Later questions from the audience pointed out that many of the problematic systems our society faces as crises are "hybrid" man-natural systems - how do you classify those?] He then presented ten stark contrasts between natural and human systems, that is, inherent differences between the two, indicating that these differences are indeed "real" and form the basis for the chasm between the two. Still, he noted that most of the differences derive from the nature of humans and are philosophically-based such as historical anthropomorphism, the supposed superiority of man, the supposed gap between living and non-living systems, and that these mind-sets become imbued in either one of the "two culture's" of C.P. Snow.

To attempt an integration, he maintained, it is necessary to explicitly express the obstacles to the proposed integration. So he cited twelve problems he has experienced in discussing integration

across natural and social systems. He discussed variously how past education and training, dominant methods or techniques, types of questions preferred or allowed, use of language, status of metaphor, analogy, and homology, and genetic predisposition differ between the two cultures and inhibit integration. He continued with differing priorities, expectations for prediction and status of determinism, differing positions on the net effect of the observer, presence or absence of correlation principles, differing perceptions on the priority of practical interventions, and differing interpretations of the words "purpose" and "function" as further obstacles to integration. These obstacles had the consequences of truncating cross-communication, crippling comparative studies, diminishing cross-fertilization, halting consensus-building, and contributing to not-always subliminal anatagonism. At this point, it appeared integration across the chasm was, indeed, doomed.

To set the stage for a survey of possible approaches to this integration, he argued that we must have reasonable expectations of its outcome, and must fulfill several prerequisites. He argued against that concept of a monolithic or singular general theory of systems. First, he advocated the necessity for a unique social systems theory and natural systems theory that is acceptable to practicing workers in each of these domains. It is the limited and particular, but potent similarities between these that would constitute the basis for theory that integrates across the chasm. Further, we can reasonably expect that these very general similarities might not allow the direct "interventions" on the local hierarchical scale that are popular with or desired by some systems practitioners and systems designers today. Still further, considerably more theoretical work might be necessary on certain bridging-the-gap isomorphies before they could be used in practical systems design. Should social scientists and systems managers decry and condemn such theoretical work in the present because it does not produce immediate results whose significance they can perceive? Certainly, a great many very effective modern solutions would have never been perfected if this were the case. Similarly, it is counterproductive for the systems movement for theoretical types to decry soft systems methods for attempting to solve immediate, local-scale human problems just because they do not come up with a generalized solutions that can be more widely applied.

Thus, the prerequisites for integration across these sometimes warring domains of systems approaches were presented as keeping an open mind, unlearning as well as relearning across the domains, respecting the unique and necessary roles of each domain, keeping the mind in an evolving state, being truly holistic and not just mouthing the slogans for your domain, being sensitive to scalar effects (way beyond the human scale), developing a mental ability to "keep track of" or "trace" scalar pathways, keeping a balance between egoless and egocentric behavior, and transcending, while admitting the true differences between natural and social systems. Finally, a central prerequisite is greeting each new idea critically with some attempt at self-criticism, rigor, or empirical/logical refinement before presentation.

Troncale then presented four arguments for models or methods that might help bridge the gap. He surveyed four alternative philosophies that appear in human history that might provide more appropriate worldviews to aid in bridging the gap. His last predicted that a new value system will emerge from systems science itself, hardly a unique prediction. It is not the prediction of this event that is important: it is the specification and implementation that is important. In the isomorphic argument he cited clusters of isomorphic processes like feedback theory, systems allometry, chaos/fractal theory, and even rarer types like the Zipf-Pareto Law to show in detailed comparisons how both the characteristic features of each process are present in both natural systems and social systems, and the consequences of each process are similar. He showed how the natural systems generic "life cycle" is similar to the human systems design life cycle of systems analysts if one carefully translates the functions of each step to better map the two life cycles on each other. In the "exemplar" argument, he briefly mentioned some examples of "hot boundary crossers" and inter-disciplinary fields that either had, or might successfully bridge the gap. He did not have the time to

cite the "roots or origins" arguments that supposedly empirically demonstrate how social systems emerge from natural systems in such a regular way that certain general systems proportions remain constant across the various emergent levels (systems allometry).

Truncating his notes on five "potential benefits" of integration across human vs. natural systems, and seven "caricatures" which degrade the attempt, he closed with a plea for abandoning the antagonism between the two cultures, and a plan for learning our way into a transcendence of past thinking that allows cooperation between the two cultures.

The next symposium speaker, Milan Zeleny, who is well known for his applications of autopoiesis to social systems, used this isomorphy to suggest the eye-opening conjecture that all autopoietic (self-organizing) systems are social systems. This is a creative suggestion since much of the past rigorous work on autopoiesis emphasizes either biological, astronomical, or computer modeling systems, in other words, natural systems. What he seemed to be saying is...not only can the gap be bridged but, in fact, natural systems share a major process with social systems and from the social systems point of view, <u>are</u> social systems. This completely reverses the focus of the conventional debate. In the course of his presentation, Zeleny suggested practical applications of the systems concept of autopoiesis to social systems design, at one point suggesting that one lesson from autopoiesis studies would advise the Soviet Union to adopt a completely different strategy for glasnost and perestroika than they currently employ (roughly he believes that autopoiesis demonstrates that a bottom-up rather than top-down process would be more successful). If, Zeleny argues, we recognize social systems <u>as</u> natural systems to which certain isomorphies apply, then the gap is already bridged: we humans just have to discover how it is bridged. He argues essentially for an ascalar view of phenomena by saying that we already are applying physics to social systems if we apply biological models to social modeling since biological models are already based on physical influences. But he divorces himself from application of one-scale methods of physics directly to social systems because these already violate his desire for a more generalized ascalar method. He, I think correctly, argues that many human-engineered systems and aggregates are <u>not</u> social systems just because they are composed of humans, but are dominated by the imposition of structure from the few to the many. To him only many-to-many evolved human systems should be regarded as social. Zeleny spent most of his time describing the minimum processes included in autopoiesis: production, linkage, and degradation and illustrating how these sub-processes are present in all scales biological <u>and</u> social, thus effectively bridging the gap.

Swenson used the systems concepts of non-linear dynamics, particularly "attractors" to meditate on the role that possible social systems level "attractors" might have in human evolution. He emphasized how in social systems (just as in a multitude of natural systems) a small difference in initial condition (ex. a new leader, a new technology, a new value) can, and indeed has, led to enormous differences in later conditions, that is, can lead to global transformations. These "singularities" as attractors are revolutionizing some of the ways we look at natural systems by showing how older, more classical Newtonian descriptions may be adequate at only certain levels of abstraction. At other levels, they fail. This failure of classical methods bring natural and social systems closer together. But only if there is also a revolution in the way we conceive of social systems. In this area, Swenson distinguished between the artifacts of humanity which retain linear, deterministic processes since they were made for purposes, and true human systems which he argued are non-linear. This clarifies a distinction not made in Troncale's presentation and which needs to be made. He pointed out that no matter what we do to create nicely behaved human systems, nature is always including a non-linear component that bedevils our attempt, and we had better grow up and recognize it (my emphasis). He showed how important these non-linear components are to creativity in the system and its future long-term evolutionary success. He ended on a similar note to Zeleny: in the future those who aspire to be social systems engineers must recognize that they cannot directly engineer results, they can only implicitly engineer outcomes

(attractors) by explicitly engineering initial conditions. I might add that Wilson and I came to a similar conclusion concerning engineering hierarchical emergence events some years ago and it is encouraging that different isomorphies are pointing at the same conclusion. Clearly, the non-linear dynamics argument would imply that natural and social systems have some very central, core processes in common to bridge the gap.

These first symposium papers emphasized isomorphies as a way to bridge the gap between natural and social systems. A second group of presentations suggested different, and in some cases, new systems methods as a way to bridge the gap. Korn, Huss, and Cumbers (presented by Korn) used linguistic modeling in general, and the construction of inference machines in particular, to provide a "consistent" treatment of natural, man-made, and human systems that they insist bridges the gap. Katsenelinboigen did not attend the meeting but in his published abstract suggests use of a social systems based method we all have experienced, human "aesthetic" evaluation, as a way of analyzing the interactions of different objects in any field. By decomposition of the judgement into sub-judgements, he provides a simultaneously subjective and objective method that applies to both *"hard" and "soft" areas.* Frandeberg and Gyllenstierna (presented by Frandeberg) suggested we use a natural systems based method, Miller's living systems analysis, to examine the dynamics of a clearly social systems entity, cities. In exploring this technique, they have incorporated a vast amount of data available through his partner, an official in Stockholm, into the Millerian classification of generic sub-systems. This enables testing such trends as cyclical variations, time lags, entropy, and cybernetic relationships for the social aggregate - city. Thus, they have attempted to test some of the cross-level hypotheses proposed in Miller's opus and since these cross-level hypotheses range from biological to social systems they have also attempted to test some of the proposed girders in the bridge across the chasm. Although preliminary, this work is very much needed.

A third group of presentations used variations on the development and evolution of the human mind and human interactions as a model for examining the chasm between natural and social systems. Langs, Orchard, and Badalamenti (presented by Miriam Tausner in the absence of the authors) used the patient/therapist (P/T) dyadic system as a model for examining both the similarities and dissimilarities between human and natural systems. By detailed recording of the course of a P/T exchange, these workers are trying to measure trajectories and deep structures, as well as explore the effects of differing boundary conditions on these measures. Using energetic measures of anxiety levels and power of imagery, it appears that the P/T system spontaneously seeks the lowest energy levels, just as certain natural systems do. The published paper, but not the presentation, closes with citation of several interesting isomorphisms between natural systems and the P/T system. Cohen's paper directly examines the session topic by reversing the usual historical review of the assumptions of the general systems movement (that there are invariances across all systems) by the startling question...do its practitioners actually accept universality, or just mouth the platitude? She continues with comments on the need to actually be able to demonstrate this universality if others are to accept it. Francois examines the educational system and how it trains us out of a synthetic vision of natural and social, and he proposes a high school program that would refrain from creating the gap between the natural and social domain in the first place.

The papers of the fourth group were the most diverse. Forsgren actually challenges the focus of the entire session stating that it is foolish to ask any of the questions upon which the session is based. Since he denies any worthwhile measurement can be made across the gap, he suggests a worthier course is to find solutions for obstacles to a healthier society, and illustrates his point with health systems. Ivanov decries some of the features of our modern information-centered, computer-centered inquiry systems simply because they become preoccupied with the issues internal to these foci and do not sufficiently relate the potentials of these tools with the need for ethical and political advances in society. He implies that systems science, for all its talk of synthesis, is actually too focused on technological tools and needs more to focus on their impacts on social systems. This

would help to bridge the gap. McNeil analyzed both natural systems as represented by the classical scientific method and social systems as represented by their worldview and notes their differences, but makes a plea for using systems management techniques to descirbe a core of positions and ideas common to both. The last two papers were case studies. Starkermann used an analysis of social interaction to indicate that aggressive interactions are dominant in human affairs and may explain why the tendancy even in the systems movement is to emphasize the differences rather than the unifying similarities (devotional interaction) across natural and social systems. Ziegenfuss takes what most would consider a human system, music, although analyzed here as a natural system, because of its obvious physical basis, and shows its similarities to human organizations. These include the proposition that all organizations have form in the sense of melody, harmony, rhythm, and timbre when these are defined as more general processes, and that there are also significant internal, behavioral, and environmental systems domains to both with similar relationships between the domains.

The workshop occurred in the early evening of the last day of these paper presentations and was well attended. The group pushed spontaneously for foundation of a SIG on this important obstacle and opportunity in the developing systems sciences. But beyond institutionalizing the debate, they conjured up several fascinating and creative alternatives which might even be more successful than our conventional, knee-jerk response of forming a group. They suggested that each general systems oriented natural scientist adopt a social scientist in the society and vice versa. They were very serious in this suggestion that arose after a discussion of how difficult it was to really grow, change, and learn after hearing a couple of presentations as much as appeared necessary to overcome past training and mindsets. They really wanted to become more ascalar and open. Some of these enthusiasts will report on these specific "adoption" plans in a future issue of the *General Systems Bulletin*. So, the workshop ended in high spirits and hope for bridging the natural - social systems chasm.

It has been many years since C.P. Snow crystallized the division felt between the natural and social systems in his phrase "the two cultures" discussed in his book (1959). Although some decry this phrase as an oversimplification, my own experience is that there does indeed exist a strong and continuing separation between two dominant, and for individual persons, inherent worldviews. This division is anathema to a unified systems science. Although we do not advocate a overarching, dogmatic, or monolithic systems science, we do suggest that there are some substantial and important commonalities between the two cultures that allow a portion of systems work to describe a unified, but "limited" systems theory which will help bridge the gap without destroying needed distinctions between the two worldviews. It is hoped that this collection of papers will result in a continued attention to bridging the gap between social systems, and their "nest", the natural systems.

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Lumsden, C.J. and E.O. Wilson (1981) *Genes, Mind, and Culture*. Harvard University Press.

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Snow, C.P. (1959) T*he Two Cultures and a Second Look*. Cambridge University, 107 pp.

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