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Chapter VII

Neo-Hermeneutic Anthropology: Directions for Additional Research

Metaphors (as used in scientific discourse) are ultimately judged by the results of the investigations they inspire. The value of the metaphor of mind (and the incipient model of mind) presented in previous chapters will not be argued and decided in these pages at this time. Instead, some directions for further research will be introduced and briefly discussed. Introducing new research directions hints at the utility of the new metaphor behind them but the utility and accuracy of the metaphor will remain in question until the suggested research does or does not yield fruitful results.

The same discussions will be used to address some of the common criticisms levelled against the hermeneutic approach - the philosophical position supporting the alternative metaphor and hence the suggested research topics.

First, and perhaps most common, is the criticism that the hermeneutic approach is so inclusive in defining its unit of analysis that nothing valuable can be said about that unit. The model developed in the previous chapters is certainly inclusive enough, and accordingly this kind of objection needs to be addressed.

A second frequently encountered criticism arises from the patterns and discontinuities that are obvious in even the most cursory examination of the entity that a hermeneuticist wishes to consider as a whole. Surely those patterns can be accounted for in terms of interactions among the discontinuities without doing violence to the whole. This criticism also needs a response.

And third, a criticism that is more an expression of bias, is that hermeneutic positions are inherently "unscientific." This criticism is reinforced when both sides of the debate persist in misunderstanding the positions taken by "the other side." Hermeneutic approaches are caricatured as denying any objective sense of knowledge or truth and formalist approaches are all equated with newtonian mechanics. Despite the mutual caricatures it is

possible to be formalist without being determinist and mechanist; and, it is possible to be interpretivist and yet build models, advance hypotheses, and establish methods and simulations that lend themselves to the verification of hypotheses and theory - to be "scientific."

In the remaining pages of this chapter three potential realms of further research will be introduced: two with a theoretical (and somewhat speculative) focus and one with a methodological orientation. Two threads weave among these brief discussions. First, a response to the criticisms of hermeneutics just noted. Second, a suggestion of how the alternative metaphor and model proposed in previous chapters might engender an alternative perspective from which to investigate those problems typical of cognitive anthropology, cognitive science, parts of artificial intelligence and related domains of enquiry.

Evolution: Adaptive Control Systems to Aware Minds

Leaf [79: 334] noted that the hermeneutic conception of mind supposes that it is "an evolved aspect of physiological function." Geertz indicates culture and the large human brain evolved synchronically rather than serially. These [and other] observations provide a foundation for arguing

that mind is the product of evolutionary changes rather than a sudden and inexplicable single change in the constitution of the human animal. [Unless, of course, one adheres to the tenets of creationism or one of its variants.]

If the neural network model is to be regarded as the foundation of an alternative concept of mind and if that concept is to be consistent with the hermeneutic position, then it should be possible to discover clear parallels between the functioning of a network across broad task domains, across species, and over the course of evolutionary history. This, in fact, seems to be the case.

Consider three simple examples. One, the fact many of the foundation principles of neural network architecture are derived from the study of the "brains" of flatworms. Two, the rapidly expanding research on the ability of neural networks to provide adaptive control of the musculo-skeletal system (or robots imitating that system). [Kawato 88] The consistency and similarity of architecture and operation principles among networks emulating widely divergent tasks like vision [Grossberg 86], optimization [Hopfield 85], and reading [Sejnowksi 86].

A potential line of research, therefore, would involve exploring the evolution of and cross-specie analysis of neural network architectures and operations in order to

discern the extent and magnitude of any diversity. A corollary objective of this investigation would be the construction of a plausible evolutionary path leading from single cell organisms responding to their chemical environment to human beings responding to their highly complex sensory environment.

It would also be interesting to determine if stages on such a path were evidenced by simple incremental increases in the size [number of component neurons and connections among those neurons] of the involved networks. This finding would be in distinct contrast to the prevailing computational metaphor of mind which would seem to require the existence of a special purpose sensory mechanism capable of apprehending symbols as symbols and not as a simple melange of sensual inputs.

If this research were undertaken, and if findings confirmed the expectations engendered by the hermeneutic position, it is likely that the distinction between humans and other animals or between cognitive and physiological aspects of human activity would be increasingly blurred. This, in turn, would tend to support the positions of Bateson [79] and others on the necessary unity of mind and nature.

If the underlying mechanisms by which mind [human or animal] and physiological function are realized are found to be effectively identical then accounting for observed cognitive differences might shift from some unknown variable within-the-network to the environment evoking cognitive responses from that network. Culture is a large and unquestionably important portion of that "evocative environment," especially for human beings. Increasing our anthropological and cognitive understanding of culture might therefore prove to be central to our understanding of mind.

Culture IS Memory - MemoryIS Culture

If culture is to be central to the understanding of mind as implied in the previous section, it is likely that our understanding of culture, per se, will change, at least in emphasis. Although culture has always been regarded, in some sense, as a kind of group "memory" the neural network model would seem to require a much more literal interpretation of culture-as-memory.

The literal understanding of culture-as-memory also provides a basis for responding to a potential criticism of the neural network model. As presented in the previous chapters, neural network models are in danger of being

perceived as nothing more than a variation on traditional stimulus-response models. Although the similarities between the neural and SR models must be admitted, there are basic differences between them that hopefully salvage the former from the potent attacks already leveled against the latter. [Notably by Chomsky.] One of the most fundamental differences is the notion of culture-as-memory.

Any cognitive model must account for memory - the preservation of the ability to recall and re-exhibit a particular behavior after the passage of time - and this accounting is a most difficult problem. As noted in previous chapters the volume and complexity of required memory is one of the strongest arguments against the standard computational model of mind.

At the root of the memory problem is Descartes' insistence that mind and environment must be completely separate and the consequent need to recreate the total environment in-the-mind (symbolically). Connectionist models are not necessarily immune from this requirement. Simply substituting connections for symbols or tokens is not sufficient.

Work has not yet advanced sufficiently to make a hard determination as to the storage capacity of a network of N nodes and M connections, but there are reasons to believe

that the capacity will fall short of the amount required to emulate human memory performance. Nor is it clear how memory can be kept from becoming an overwhelming interference to the processing of immediate environmental inputs.

The alternative model offered in previous chapters suggests that memory is not the outcome of changes internal to mind but of the evocative environment external to mind. This is true for both collective and individual memory. Such a notion immediately satisfies the immense storage capacity required for memory to manifest itself.

Although this notion of external memory might appear to be a radical innovation, the differences between it and traditional notions of memory are relatively minor. For example, all of the verbs that are commonly associated with memory (to memorize, to recall, to store, etc.) remain intact. Our descriptions and common sense understanding of memory is not affected. Only the substitution of some unknown mechanisms for altering the external environment for some equally unknown mechanisms for altering the internals of mind is involved for this concept to be realized.

A second research direction, then, is to investigate exactly how culture is employed as individual and group memory. How are deliberately, non-consciously, and even serendipitously made changes in the external environment

used to subsequently evoke the appropriate states-of-mind required for a human being to make an appropriate cognitive response or take a cognitive action.

One mechanism that presents itself as a focus for this research is how increasing the regularity and ubiquity of inputs associated with a particular mental-state contribute to the ability to recall that mental-state and the behaviors derivative of that state.

Let the Description Fit the Problem

> "... the search for order itself [need not be abandoned], but only an ambitious and unrealistic concept of the kind of

> order we can expect to find in human behavior and thought. ... instead of simple, mechanical descriptions, we must aim for descriptions of patterns in the behavioral and ideational aspects of community life that will be statistical (with many exceptions). The order that we ultimately find may not be the intuitively obvious one." [Johnson 78: 6-7]

Anthropologists, especially cultural anthropologists, are not, by and large, mathematical sophisticates. Cultural anthropology is, after all, a qualitative science first and quantitative only reluctantly. Although the preceding characterization is changing to a degree ("statistics" is no longer a dirty word and even some form of "computer

literacy" is increasingly expected), it remains generally accurate - at least when limited to the presence of explicit mathematical treatments in ethnographies.

Hage and Harary [83] convincingly argue that anthropological theories have always contained a strong implicit mathematical structure. They advance strong arguments for using graph theory to make the implicit mathematics explicit and therefore clearer and more amenable to manipulation. Thomas [76] and Johnson [78] also advance arguments for the increased use of explicit mathematics, in their case statistics, in anthropology.

Whether such approaches would ultimately improve our understanding of culture or provide yet another instance where standard formalisms seem inadequate to the phenomena is an open question. What is abundantly clear is that it is possible to reject existing formalisms and mathematical systems without the need to reject the possible existence of a formalism that is adequate to the phenomena of interest.

The model developed in the previous chapters is wholistic and chaotic (described as a "maelstrom of inputs"). It would seem reasonable therefore to look for formalisms or mathematical systems that describe the behavior of non-linear highly dynamic systems. Such a tool

is provided by a relatively new branch of mathematics called, not coincidentally, "chaos theory."

Chaos theory combines a number of mathematical techniques and theories whose commonality is the type of problem they describe. Roots of chaos theory are firmly planted in biology, engineering, physics, thermodynamics, and meteorology. They are increasingly applied to domains like neurology, economics and even sociology. It is not unreasonable to expect that they might be usefully applied also to anthropology.

Without going into detail,[1] chaos theory offers three specific analytical paradigms that seem appropriate to cognitive anthropology: the power of recursion; order arising from randomness; and, connectedness.

Recursive functions are those that are circular and iterative.[2]When the function is calculated and re-calculated a number of times the results can manifest unexpected complexity and order. Perhaps the most notorious example of such results at the present time are the fractal patterns derived from the work of Benoit Mandelbrot [83].[3]

1 An popular introduction to chaos theory is provided in Gleick 87.

2 Recursion is defined in terms of relations, functions, procedures, and recursive conditional expressions. [Ralston 76:1209-1211] A very simple example of a recursive relation is the equation:

$$f_{n+1}= f_n+ f_{n-1}.$$

When observing a typical fractal based image one is struck by the immediately obvious patterning, symmetry and self-similarity. If one were tempted, however, to explain the pattern by dissecting it into elements and establishing relations among them it is unlikely in the extreme that the actual generative formalism behind the pattern would be discovered. The question is then raised as to whether or not the culture-mind entity proposed in the previous chapters is more properly described as the product of an as yet unknown recursive function; or, as is typically the case, in terms of relationships among what appear to be obvious structures in the overall pattern?

A second analytical paradigm is the power of randomness to generate order. The randomness paradigm demonstrates that complex patterned results can be generated even when the generative function is randomized. One example is the ability to generate a given image, a black spleenwort fern perhaps, with a simple set of rules and a random number

3 Aficionados of science fiction and careful observers of commercials are frequently treated to fractal images of even greater complexity and which have startling similarity to a number of natural and biological forms, including landscapes, tree bark, waves and clouds.

generator to determine which rule to apply during each iteration of the process. [Gleick 87]

Randomness might apply to anthropology in situations where complex patterns are observed, like patterns of exchange and social organization a la Barth [66] and his followers [Kapferer 76]. Conventional approaches to exchange result in an ever increasing set of rules about what kind of exchange is made in what kind of situation and how an aggregate of exchanges results in a specific type of social organization. The randomness paradigm suggests that the same complex order might be better explained by a limited set of rules (perhaps not technically exchange rules) which are randomly and iteratively applied through the actions of hundreds to millions of individuals.4

Whether socio-cultural patterns can be unravelled, and if so, whether they are amenable to the same kind of random generation as natural phenomena like plant and animal

4 Hidden within this suggestion is the notion

that emic explanations of what is happening are rationalizations of an observable surface pattern. This in turn opens the debate over emic and etic interpretations of a given event: Which is more accurate? Is an insistence on etic interpretations
[continued next page]

structures [See D'Arcy Thompson 61] remains to be discovered.

Wholism or inter-connectedness is the third analytic paradigm to be discussed here. An oft hidden assumption behind the description and theory of system behavior is that minor effects have no long term or major influence on the state of the system as a whole. An example would be the assumption that a leaf falling from a tree in Europe has no effect whatsoever on the gypsy moth population in the pacific northwest forests of Washington and British Columbia.

As commonsensical as this assumption may seem, chaos theory has demonstrated that it is not necessarily true. Under the rubric of the "butterfly theorem," it asserts that in some kinds of highly-dynamic chaotic systems something as evidently innocuous as the fluttering of a butterfly's wings

[footnote 3 continued]
an exercise in "intellectual colonialism?" Although some would argue the extreme position that etic propositions like conservation of energy are ethnocentric, most would make a distinction between such natural propositions and debatable propositions like those found in economics. If this distinction is accepted then the randomness paradigm would fall in the category with other

natural propositions and would apply equally to every existing and possible cultural system.

in Brazil could affect the weather patterns responsible for a drought in Kansas.

This kind of theory is closely related to "Catastrophe Theory," which is generally attributed to Rene Thom. In certain kinds of systems, even multi-dimensional linear systems, it is possible for a very minor change in one dimension to precipitate a very major change in another. Catastrophe theory has been widely applied in population biology, to some extent in physical anthropology, and in ecology.

Anthropological puzzles, like the collapse of civilizations, are excellent candidates for analysis from the perspective of chaos theory and the butterfly theorem. A civilization might be analogous to a pot of boiling water where a gradual increase in temperature results in the generation of a highly regular pattern of convection currents (social patterns). As the temperature continues to gradually increase a minute change suddenly precipitates a roiling chaos of convection currents which might again stabilize into a regular pattern as the temperature continues to increase.

As intriguing as any of these paradigms might be individually, they are more appropriately considered together, as a set of related approaches applicable to dynamic or chaotic systems. The model of mind-culture that was presented in the previous two chapters is precisely the kind of system to which chaos theory might be appropriately applied.

To do so would be to redefine anthropology as a science. The grounds for doing so are the same advanced by Aberle [87] and others disenchanted with the long prevailing, frequently covert, Newtonian, formalist (narrow sense), mechanist approach to culture and cognition. History, however is perhaps not the best model for a redefined anthropology. A better case might be made for meteorology as that science has been enhanced by the application of chaos theory derived mathematical tools.

This is not as radical a change as might first be surmised. Most of the data and ethnographic descriptions of anthropology would retain their value and utility. The primary difference would arise from a redefinition of the theoretical role played by typical anthropological constructs (kinship, tribes, cultures, behaviors, symbols, artifacts, etc.). Such constructs would be seen as analogous to the macro and micro patterns evident in meteorology (fronts, lows, highs, thunderstorms, hurricanes, etc.), i.e., as by-products of the underlying chaotic, non-linear, non-deterministic system.

This new role takes away the causal power that is frequently attributed to certain patterns. Instead of explanations of one surface pattern (e.g. distribution of wealth) in terms of another (e.g. kinship), both would be seen as products of a common generative (quite possibly random) process.

Most affected by such a change would be those theories that propose an explanation for all of culture derivative on one specific aspect (or occasionally a tightly related, small set of aspects). To this type of theory the chaos orientation would say:

> "Just as you cannot make a man by shaving an ape, or destroy a hurricane by exploding a nuclear bomb at its center, you cannot change a culture by altering its mode of production.
> If you wish a man rather than an ape then make some relatively minor changes in a strand of DNA. If you wish to abate the power of hurricanes lower the temperature of the atmosphere by as little as five degrees on average. If you wish to change a culture seek and alter those generative (not symptomatic surface) forces that lie at its generative core. Do not expect, however, to shape the new culture - the system is not determinable. In chaotic systems, you can eliminate the now but not determine the next."

Although some changes in theoretical orientation come quickly to mind (preceding examples), the full re-construction of a chaos based science of anthropology is an

extensive task, one with many parts, each of which is a valid direction for future research. These changes apply equally to sub-disciplines within anthropology like the cognitive domain central to this paper.

Future Research Projects

Discussion of research directions to this point have been general and semi-philosophical. In this concluding section I wish to present six candidate areas for shorter term, more specifically targeted, research activity.

The first area concerns cognitive aspects of cultural change. The specific question is the extent to which the simple presence of a new "object" (set of inputs) in the input environment reshapes the environment as a whole. Corollary questions include:

- What kinds of objects are likely to induce a "catastrophic" change? (Examples include the automobile and computer in modern Western society.)
- How does a new set of inputs acquire a "meaning?"
- Must an object have a "meaning" before it begins to influence behavior.

The most promising venue for undertaking this kind of research is the area of computer technology (particularly AI) and the introduction of that technology to new cultural environments.

A second area is an attempt to modify or adapt computer based chaotic tools to anthropological problems. This task would involve selection of a specific problem domain and the translation of existing data into a form consonant with the modeling tools available.

Perhaps the most important (and regrettably the most idealistic) area of future research concerns the search for the generative principles that result in patterns that are not only evident but odious as well. Obvious targets for this type of research are power and wealth inequities, sexism, and racism.

The last three problems derive directly from the neural network model proposed in earlier chapters.

1) Devising programs for existing networks that can test the ability of a network to enfold and still realize multiple kernels.

2) Devising programs that test the predictions for high vs. low regularity inputs to the same network. Are inputs present in every iteration "learned" sooner? Are they distinguishable during intermediate stages of the

program run or are they hidden until the total learning task is complete? Are low regularity inputs discernibly associated with nodes active in high-regularity input learning?

3) Building a network, or simulating a network, that implements constraint windows as introduced here. Specific questions of interest include:

- Whether CWs operate as "filters" that prevent inputs from changing topological states or as active pre-determinants of topological states?

- How to determine and set values for constraint window implementation? This directly ties into making a model of cultural influences on cognitive activities.

The specific purpose of the last three research activities is to articulate and validate the proposed model. In conjunction with all the other research activities and the general research directions, the purpose is to build better models to advance understanding of human activity and cognition without abandoning a philosophical approach that is particularly appealing to a number of anthropological, cognitive science, and artificial intelligence researchers.