The Contact Hypothesis:
On the Impossibility of Sustained and Mutually Beneficial Contact between Aliens, and Two Proofs to the Contrary

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Editor's Note: Will it be easy, difficult, or impossible for humans and an advanced alien intelligence to understand each other? The potential difficulty of such communication was a prevalent theme during the Hawaii seminar.

Fortunately, a dissenting view has been presented by Dr. Reed Riner. He tackled this question carefully back in 1985 in this unpublished paper presented at the third annual CONTACT conference. His conclusion is that sustained and mutually beneficial contact between alien cultures is quite possible.

Professor Jim Funaro, the founder of CONTACT, has graciously permitted us to include this revised version of the paper in the present volume. Current information about CONTACT can be found at http://www.cabrillo.cc.ca.us/contact.

The role-playing at CONTACT usually involves a human team and a flesh-and-blood alien team, but the March 2000 meeting experimented with a fresh paradigm. The alien team consisted of highly advanced artificial intelligence (a super-smart computer embedded in an alien probe that had reached Earth). It had monitored our telecommunications, including the World Wide Web, and learned our languages. The two teams were in different rooms and communicated only by text. My assessment is that the two teams overcame their inevitable communications difficulties quite rapidly, and conducted a simple but successful dialogue during the 50-minute simulation. After experiencing this dialogue as the leader of the human team, I became quite optimistic about our chances of successful communication with an alien intelligence.

—Allen Tough

Introduction

In this discussion I attempt to demonstrate that sustained and mutually beneficial contact between alien intelligences and cultures is possible.[1] First I will appraise the logistics of this third CONTACT conference. Then I will offer four other ethnographic examples in which this kind of contact has happened and argue through examples that because contact between cultural aliens has happened before, it can happen generally. Briefly I will suggest how this ethnographic line of inquiry may be extended. Then I will draw some generalizations from the examples, and argue for the legitimacy and productivity of considering culture as if it is a formal system, which it may well be. In this context I will propose a more formal argument of the contact thesis, and suggest with four examples how this line of inquiry may be extended.

The Continuity of CONTACT

The title and theme for this paper were suggested by Jim Funaro this past year (1984/5) in a series of telephone conversations. For a few grim months and for several kinds of reasons it appeared that we might not have a CONTACT III…or IV or V or VI. But we are here, and that is why I want to begin by celebrating the continuity of our CONTACT.

1. In preparing this paper for publication after 15 years since its original conference presentation, I have pruned and moderated the rhetoric that was intended to amuse as well as to stimulate an audience composed mostly of friends and acquaintances, and I have updated many of the citations. My remedial expansions and clarifications in the body are set off in italics and footnotes. Many of the examples are now dated, and the developments and refinements during the interim merit incorporation, along with the keener insights and criticisms into the argument.

I have retained from the original version the thread of celebration of CONTACT, and I still believe that it will be possible to find common denominators for meaningful communication with extraterrestrial aliens, and languages, media to convey meaning in the event that we meet—or create—sentient aliens.

Sometime in 1981/2 Funaro began work on a project, the success of which seemed highly improbable. He intended to summon, to lure, and otherwise entice, representatives from three mutually alien cultures—some science-fiction writers, some graphic and performing artists, and some anthropologists—out of their traditional territories. He proposed asking them not just to meet each other, but to collaborate, deliberately and enthusiastically, in a mutually beneficial process of sustained contact.

Considered analytically, this enterprise required organizing on at least seven different levels. The participants, coming from different cultural contexts, would have to:

1. Be funded, transported, housed, fed, etc.
2. Be supported with local arrangements, publicity, etc.
3. Get to know and trust one another as individuals.
4. Learn each others' languages and frames of reference, and discover common currencies of reciprocity and exchange.
5. Discover what resources—and needs—each individual and group had to contribute to the enterprise.
6. Invent some processes for interaction, some roles and role-relationships.
7. Invent a vision of beneficial common purpose.

It is always best to start this kind of project by building a small system that works (Weick, 1969:105-108). Seven levels of organization is not a particularly small system; it approaches the complexity of inventing and engineering a whole culture (Jay, 1971; Weick, 1969:6). I'm sure skeptics laughed when Funaro first sat down at the typewriter, and hasten to note that he now uses a MAC to manage this extended exercise in problem-solving behavior.

Some of the parts of this manifold task were easier than others. He had, initially at least, a host of eager minions to whom component parts of the larger task could be delegated. He carefully selected the agents for contact who were already motivated to communicate with one another—writers who thought and wrote anthropologically, and anthropologists and other social scientists who were as interested in alternative and hypothetical cultures as they were in actual ones. Artists to mediate between them. Funaro had a sketch of structure, one that created a true "field" by combining the complementary processes of critical observation, the symposia, and subjective participation, the simulation activity, the first Bateson Project. And he had a generally defined objective, inspired by conversations with Gregory Bateson; their common objective was not quite so general as "to boldly go where no minds had gone before," but more specifically to explore and define the limits of our concept of "the alien" and the possibilities that would follow from contact with the aliens through the process called play.[2] Never, of course, has there been any question that structured information, ideas, art, and knowledge would emerge as the currency of this exchange.

These resources notwithstanding, forging a sustained and mutually beneficial contact among such aliens was unlikely. It is generally thought that any meaningful communication with alien intelligences is impossible. There are serious arguments against it:

- What is the likelihood that any alien intelligences exist?[3]
- What is the likelihood that we will ever encounter them?
- What is the compound probability that they and we will be motivated to communicate with each other?
- What is the likelihood that we will be able to communicate with each other?
- What is the likelihood that any kind of sustained and mutually beneficial relationship could result from such communication?

The answer to these questions is the product of their five likelihoods, and that is a very small number indeed. It would seem to be a probability that borders more nearly on impossibility, or fantasy, than on likelihood.

The fact that we are here, that we can celebrate the continuity of our CONTACT, is one empirical demonstration that sustained and mutually beneficial contact between aliens can be achieved. Our CONTACT provides us with an immediate and concrete, if micro, example of sustained and mutually beneficial contact between aliens. We are participant-observers embedded in a field that is our own continuing cre-

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2. Critical, often peer-refereed, dialogue about the "other" surfaced in anthropology in 1985, well-exemplified by Jacob Pandian's *Anthropology and the Western Tradition* (1985).

3. I wrote in ignorance of the Drake Equation; see http://www.seti-inst.edu .

ation, and a pretty fancy piece of applied anthropology it is, Mr. Funaro.

Ethnographic Examples

But one case, especially under the limited and favored circumstances that support CONTACT, should not be, by itself, generalized to a proof.

The most voluminous argument against alien contact is not one of slim odds for their—the Aliens'—existence and the possibility of our contacting them, of imperialistic CONTACT. I think we can accept the reckonings of contemporary cosmologists that the probability for this is 1 (one). Rather, the reigning argument against sustained and beneficial contact proceeds from the apparent fact that most instances of culture contact in OUR historic experience have resulted in the emasculating subordination of one party by the other or the destruction of one or mutually by both parties. The popular image of alien contact situations is: "They destroy, enslave, colonialize us, perhaps inadvertently, or we would do that unto them, however inadvertently, or we both destroy each other…inevitably because of an inability to communicate."

It is pertinent to note that simultaneous with this, our CONTACT-III (1985) conference members of the European Federation of Intercultural Learning and the World Futures Studies Federation are convened in Rome (26 Sep–1 Oct, 1985; *the CONTACT venue was subsequently reset to the now-traditional 1st weekend in March*) to discuss: "Common Values for Humankind: Is Cultural Diversity Compatible with Peace?" (WFSF Newsletter, 1985:3-5). The gloomy supposition about contacts with cultural aliens is acceptable if one's examples are drawn only from the domain of conventionally recorded history. But that sample is deceptive because it is drawn from a single category—the realm of imperial states; it is that pernicious "sample of one" again.

Conventionally recorded history, our own sample of one, is the product of nation-states and empires, those hierarchically organized sociocultural systems in which "history" has been written by the elite, about the elite and for the elite—that favored 10% of the population at the top of the power pyramid, and consuming 90% of the product. A broader, more legitimate sample should include the cultures from outside of history: the bands, tribes, and chiefdoms who collectively represent well over 98% of the sum total of human experience, whose history is oral, mythological, and archaeological, and whose organization is other than rigidly hierarchical. This broader example provides numerous examples of nondestructive, sustained, and mutually beneficial multicultural contacts. The Pomo trade feasts in central California, the Iroquois and Creek Confederacies around the Great Lakes, the Taos Pueblo trade fairs that preceded white contact, and the pre-contact trade networks that connected the Pacific Coast and the Greater Southwest all illustrate sustained and beneficial contacts. The Bantu-pygmy symbiosis provides an example from outside the Americas (Turnbull, 1963). But three of the most conspicuous examples, examples that illustrate mutually beneficial contact at three successive level of sociocultural integration, are potlatching on the Northwest Coast of North America, the Kula Ring in the Melanesian Pacific, and the symbiotic relationship among the Kohistanis, Pathans, and Gujars in the Pakastani State of Swat. I will describe each briefly.

Potlatching was a system of reciprocal feasting and gift-giving among some 31 or more different chiefdoms representing seven language families and three different linguistic phyla, distributed along the 1500 miles of the Northwest Coast from the panhandle of Alaska down into Oregon (Spencer & Jennings, 1977:116-118). The reciprocity of feasting ameliorated the negative effects of local scarcities and surpluses. The gift-giving had longer-range effects, temporally and geographically, allocating both material and non-material commodities—tools, the products and formulas of the plastic and performed arts, and elements of ideology. These kinds of allocations were effective both within and among the participating cultures. The combination of feasting and gift-giving had the further effect of keeping settlement and land use patterns in a continuing non-depleting relationship with the ecology (Vayda, 1961; Piddock, 1965; Suttles, 1960).

In Melanesia, diametrically across the Pacific from the Northwest Coast of North America, the Kula Ring of inter-island trade facilitated sustained and mutually beneficial culture contacts among 16 island-based cultures—and perhaps as many as a half-dozen more peripheral participants. The Ring spanned an area roughly 200 miles in diameter, and included 16 routes, the longest of which was 130 miles. These were traversed by large expeditions in outrigger canoes connecting the cultures in "trade, magic, ceremonial exchange, overseas travel and pleasure seeking" (Malinowski, 1922; Hoebel, 1972:349, also Hunter and Whitten, 1976: 248—

250). We can infer that this system provided extended benefits comparable to those of potlatching.

The case in the mountainous Pakistani Northwest frontier state of Swat provides a different kind of example. Here 30,000 Dardic-speaking, village-living Kohistanis, organized into loosely connected patrilineages, subsist by irrigated terrace agriculture and transhumant herding. They share the territory with 450,000 Pashto-speaking Pathans who are organized into a complex multi-caste society on an intensive agricultural base—and with an uncertain number of Gujri-speaking Gujars, four patrilineal clan/tribes of nomadic herdsmen. The whole system is characterized by the stable co-residence of the three ethnic/linguistic groups. Each group exploits different but interdigitated ecological niches and is linked to each of the other groups in symbiotic economic relations (Barth, 1956).

Examples of sustained and mutually beneficial culture contact seem to proliferate outside the states, outside those systems that are organized in terms of asymmetrical and exploitive power and economic relationships. This pyramidic organization in the examples known to us is justified and legitimized by dualistic and patristic background assumptions that posit an equally asymmetrical relationship between humans, nature, and some ultimate reality—like Heaven or Utopia. Also note that organized warfare with uniforms, ranks, codified tactics, and strategies, and the motivation to conquest seem to be unique to the state category of sociocultural systems. This strongly suggests that exploitive, destructive relations between cultures is a phenomenon derivative from some kinds of cultural organization and not from others, and previous samples have looked only at the state kind.

We also observe that, while the examples of constructive contact cluster outside the state category, they are not ubiquitous there; this seems to imply that however beneficial and desirable they may be, there is a certain kind of improbability about them. The improbability of these kinds of events supports rather than challenges my argument. The contact process can express a quest for a higher level of organization and for intelligence. Intelligence and organization are expressions of a single process: the systematic removal of randomness, of equivocality, and of ambiguity, and overall the reduction of entropy (Weick, 1969:29; Hofstadter, 1979:629-32). This process is encoded, made manifest in structures and organizations (Bohannan, 1973). From this it follows that the more improbable the structure and organization of an event, the more intelligence lies behind it. The converse is equally true.

The ethnographic examples differ in an important respect from the CONTACT example: they evolved—slowly, arbitrarily, pretty much by trial and error. CONTACT, by contrast, was preconceived and deliberate, planned. Our CONTACT more nearly approximates the suddenness with which extraterrestrial contact is apt to occur—suddenly if not intentionally.

Regardless, it would be instructive and immediately useful, to proceed with an exercise in controlled comparison over the seven levels of organization that we can see in our own CONTACT situation to discover exactly what more specific significant features these—and similar—cases hold in common. I will defer that to another time because I have demonstrated that there is a sufficient number of well-documented cases to support the thesis that mutually beneficial contacts have been devised and sustained among mutually alien human groups—across the broadest differences in ways of thinking that we know.

Generalizations

Now I want to draw some generalizations from the preceding as a way of moving into the formal proof. People who have thought about how intelligence could evolve propose a kind of creature that may be legitimately, if sparsely, described as "creatures who have a carbon-based biology, are bigger than Irish setters and smaller than grizzly bears, have heads centralizing the primary sensory and data processing functions at one end, and excretory sphincters, or their equivalents, at the other" (de Camp, 1939; Clement, 1974). These assumptions are reasonable and sufficiently general to apply in specifying our category of "alien." *Further, this kind of alien will be motivated by a hierarchy of basic needs akin to that described by Maslow (1970, 1971), a system that mediates between whatever "biology" characterizes the alien, and the information system that directs its behavior.*

We may also generally say of these creatures that they are:

1. Surviving, communicating creatures who are intent on extending their abilities to control and predict their physical surroundings.

2. Creatures who have evolved matched sets of sensors—effectors for dealing with their physical situation.
3. Creatures who possess the ability (and the motivation) to tackle hard problems—ones that are interesting, rich, and non-trivial in the mathematical sense of the word; in other words, they can learn.

(Minsky, 1985:128.)

No one knows where the fuzzy grey line between non-intelligent and intelligent behavior lies; in fact, to suggest that a sharp borderline exists is probably erroneous. The essential abilities for intelligence are certainly:

- To respond to situations very flexibly
- To take advantage of fortuitous circumstances
- To make sense out of ambiguous or contradictory messages
- To recognize the relative importance of different elements of a situation
- To find similarities between situations despite differences that may separate them
- To draw distinctions between situations despite similarities that may link them
- To synthesize new concepts by taking old concepts apart and putting them together in new ways
- To come up with ideas that are novel

(Hofstadter, 1979:26.)

Now, having specified and restricted the category of what constitutes a plausible, sentient, and generalized "alien" I must collaterally make more explicit what I will mean by "culture" in the more formal proof.

Culture consists of patterns,
explicit and implicit,
of and for behavior
acquired and transmitted by symbols,
constituting the distinctive achievements
of human groups,
including their embodiment in artifacts;

(and that)
the essential core of culture
consists of traditional
(i.e., historically derived and selected)
ideas and especially their attached values;

(and that)
culture systems may,
on the one hand,
be considered as products of action,
and on the other
as conditioning elements of future action.

(Kroeber and Kluckhohn, 1952:181)

Or, as Kluckhohn said elsewhere, "all those historically created designs for living, explicit and implicit, rational, irrational, and nonrational which existed at any given time as potential guides for action." (Kroeber and Kelly, 1945)

Culture is patterns and ideas—organized information as shared among members of a population. A culture, more precisely a cultural tradition is, therefore, a kind of pool of information elements, encoded as signs and symbols. These elements are invented or borrowed, organized and used, more or less self-consciously, by one or more species. They are the technology that enables intelligence, just as genes and chromosomes are the technology that enables life. The increasing number of chimps, gorillas, and orangutans, three different species of higher primate, acquiring some proficiency in American Sign Language demonstrates that cultural elements can be transmitted across species boundaries.

This description of culture also includes the idea that culture is a system of doubly encoded information. It is encoded once in the mind of the culture bearer and once again in observable, sometimes relatively permanent, utterances, actions, and artifacts (Bohannan, 1973), or as artifacts, phenomofacts, and mentifacts (Kealiinohomoku, 1975:19,21,26), or as genes, memes, and ideons (Brown and Greenhood, 1985). Only when this second coding occurs do parts of the information system become manifest, shared, part of culture, and accessible to study. *Culture is an information-based, intra-, inter-, and extrasomatic, intentional system, the use of which is the strategy of adaptation employed by, potentially, a multitude of species. (Humans are born without culture and have to learn it; if they fail to learn it by puberty they seem to loose the ability to learn culture and do not achieve human developmental potential.)*

Formal Proof of the Contact Thesis

The preceding generalizations about "alien" and "culture" provide us with the minimum requisites for intelligence and with solid ground for examining cultures as systems akin to artificial intelligence. This

more formal proof of the contact hypothesis must now bring these two together. It must show first that there are universals of intelligence that can provide a common ground for communication between alien intelligences. Then it must show or persuade that these universals of intelligence will result in universal patterns of culture that can provide a common ground for sustained and mutually beneficial contact between alien cultures. Finally the formal proof should identify the kinds of patterns these are likely to be.

Part One, a formal argument for the possibility of "Communication with Alien Intelligence," has been presented by one of the founding deans of artificial intelligence research, Marvin Minsky (1985). Let me recapitulate.

From a Principle of Economy, Minsky argues that every intelligence must develop symbol systems[(4)]. These systems would represent things, causes, and goals, and be used to formulate and remember the procedures developed for achieving such goals. He contends that only a symbol system can enable a creature to solve the wide range of new, different kinds of problems with a speed sufficient to be recognized as intelligence. In fact, Minsky seems to equate the development and use of a symbol system with intelligence; we cannot determine from the remainder of his discussion whether he is talking about universals of intelligence or universals of symbol systems. Minsky's position, we infer, is that such a distinction is irrelevant, that no alternative is possible.

Minsky proceeds to offer us three sets of capacities requisite to intelligence. These sets of capabilities address respectively the creation, the representation and transmission, and the content of knowledge. With respect to the creation of knowledge, Minsky argues that seven abilities are requisite to the effective manipulation of symbols in learning quickly how to solve hard problems. This set includes the abilities to:

Break hard problems into simpler ones (sub-goals)

1. Make descriptions based on parts and relations
2. Explain and understand how things change
3. Accumulate experience about similar problems
4. Efficiently allocate scarce resources
5. Organize work before filling in the details (to plan)
6. Provide for the problem-solver's own welfare (to possess self-awareness)

Minsky's second set of requisite capacities concerns, more particularly, the representation and transmission of knowledge. He argues for the inevitability of:

1. Object symbols—representing objects, ideas, processes and events
2. Difference symbols—representing differences between, and change in, objects
3. Cause symbols
4. Clause structures—for simplifying and embedding complicated structures

Minsky then argues for a Principle of Sparseness, which entails universals with respect to the content of intelligence. "Every intelligence," he says, "will eventually encounter certain very special ideas because these particular ideas are very much simpler than other ideas with similar uses." He finds examples of these ideas in arithmetic, causal reasoning, economics, utility, linear approximation, probability, and the simplest program-like processes. *The Periodic Table of chemical elements and the Mainstream distribution of stellar types provide additional examples*. These are ideas, information structures, that have no easily accessible alternatives. They stand out as "islands of efficiency" in the open sea of all possible lines of thought. The implication of this Principle of Sparseness is that systems of intelligence cannot proliferate in an unlimited number of directions and configurations, but rather that all of them must exhibit a common central tendency toward the most efficient structures that connect those "islands of [cognitive] efficiency."

Minsky's conclusions dovetail with an extensive body of anthropological literature that, taken together, demonstrates the essential processual unity of the phenomena we variously observe and label as "pre-articulate semantic deep-structure" (Chafe, 1970); "mind/intelligence"(Bateson, p.c. Apr 1977 in Riner, 1984); "problem-solving/ organizing behav-

4. Symbol—any representation of an element of thought, from written character to elaborate choreography, to which meaning or other significance is attributed by the users, the characteristic that Hockett designates as "arbitrariness of patterning" in his identification of the ten distinctive features of language (1960), whereas sign designates a simpler, more mechanical, physical and invariant connection between the sign and what it signifies, as smoke is a singular and direct product of fire. The naturally occurring languages of humans are symbol systems that incorporate elements of simpler sign systems.

ior," "language" including symbol systems generally, and "culture" (Brown and Greenhood, 1985; Bohannan, 1973; Frelich, 1975; Gardner, 1985; Fox, 1979; Jung, 1916; Kearney, 1984; Miller, 1978; Powers, 1973; and Weick, 1969).

In other words, these differently labeled phenomena are expressions in differing media of a few common processes—a system of a few rules and all their consequences. We can expect principles of organization that apply at one level and in one medium to apply at all consequent levels and in all media—in each case limited and molded by the particular context and medium of expression.

Common processes, it follows, will result in common, at least isomorphic, products and patterns of expression. My thesis in this more formalized argument is that the common processes, these universals of all kinds of symbol systems and small sets of rules, provide the foundation for both communication and sustained and mutually beneficial contacts among aliens. Now it remains to illustrate what some of the kinds of processes and patterns are that we can expect to find as universals in alien—terrestrial and extraterrestrial—cultures. Four come immediately to mind[5]; these are:

1. Small sets of rules
2. Recursive systems and fractals
3. Decision trees and expert systems
4. Popping levels to generate meta-rules

Let me explain each of these processes and point to one or two examples of its cultural manifestations.

Every Principle of Economy will argue that fewer resources are expended in following a smaller set of rules than in following a larger one. This conservation of resources does not, however, limit the productivity of a set of rules. The ten definitions and postulates, including the rule for congruence, are sufficient to establish each of the Euclidean and non-Euclidean geometries, each of which is potentially unlimited in its expansion. Fewer rather than more rules actually increase the flexibility of their application.

A cultural example of this is provided by the case of human kinship systems, elegantly in the case of the aboriginal Australian Arunta's marriage rule that ego shall marry his mother's mother's brother's daughter's daughter—a rule that can be abbreviated: EGO = mo-mo-br-da-da. The context for this rule is created by the simple system of paired, complementary, and asymmetrical distinctions of age, sex, and descent (vs. affiliation), the distinctions that are universal in kinship categories. There are only six effective pairs[6], a very deceptively simple set of rules. In this context the easily learned rule results, in the ideal, in the generational and reciprocal exchange of mates between each pair of most distantly related descent groups in a system of eight groups. It takes eight colors and a three-dimensional, seven-generational event space to portray the proper and expected organization of Arunta society. (Service 1978:20-26).

The extent and complexity of effort that goes into describing this system illustrates another distinctive feature of small sets of rules: their asymmetry. While a small set of rules can generate a very complex system, seldom if ever can a very complex system be described in a small set of rules. The Arunta case does not belie this asymmetry; the rule was in fact elicited not by analysis of observed cases, but by an ethnographer who asked an insider to the cultural system.

John Horton Conway's remarkable cellular automaton simulation "game," LIFE, illustrates some other significant features of small sets of rules (Gardner, 1970a,b,c; 1971a,b,c,d). There are only six rules in this small set:

1. LIFE is played in a tessellated field—usually a regularly tessellated, two-dimensional field like a sheet of graph paper
2. The player fills an arbitrary configuration of cells—and applies the next three rules repetitively:
   a) SURVIVAL—every cell with two or three neighbors survives and is copied into the next generation.
   b) DEATH—every cell with one or no neighbors dies of isolation, and every cell with four or more neighbors dies of overcrowding; their cells are emptied in the next generation.
   c) BIRTH—every empty cell with exactly three neighbors is a birth cell; these are filled in the next generation.

5. These four were current "hot topics" in 1985; in 2000 I would focus on the modeling of systems' dynamics and simulations, including how these incorporate the examples here.

6. The pairs are WIfe-HUsband, MOther-DAughter/SOn, FAther-DAughter/SOn, and SIster-BRother; all extended kin can be specified by concatenations of these six role labels, entailing modifications on the six fundamental relationships they describe.

3. Rules 2b and 2c are applied "simultaneously."

LIFE illustrates the variety of small sets of rules that constitute recursive systems—systems in which one set of rules is applied repeatedly to its own sequentially generated and transformed products. The rules in the game of LIFE are deceptively simple, but the products are curiously complex. Every population entered into this process exhibits a tendency toward, and/or complete conservation of, spatial symmetry. While most configurations disintegrate and disappear within a few generations, some small percentage of them arrive at stable, usually regularly oscillating, end states (ethnographically illustrated by *gumsa* and *gumlao* (Leach, 1954)). A yet smaller number of initial configurations continue in unlimited evolution, and a very small number of these generate offspring who go on to live autonomous lives of their own. This last small number of configurations are unusually *intelligent*, we are forced to say, and no doubt closely related to Minsky's "isolated islands of (cognitive) efficiency."

The products of LIFE, like those of so many recursive processes, are temporally asymmetrical: one cannot predict the configuration of any future generation (except by working it out, which is not prediction); neither can one reconstruct the configuration of the preceding generation, even if you do try to work it out. Each population's future is unpredictable, and its past is unreconstructable…so long as you are working from outside the system.

The products of LIFE present yet another curiosity: many of them appear to be fractals. Fractals are structures or patterns of information that are self-symmetrical. That is, a small piece of a fractal structure mirrors the shape of a larger piece, like holographic images in popular understanding, and the whole structure exists in a fractional or decimal dimensionality somewhere between 1 and 2, 2 and 3, and, we suppose, on beyond that. Fractals are the kinds of structures that one sees in Brown-and-Greenhoodian movement and thermonuclear turbulence, in the distribution of metals in the Earth, and in the bonds and bends of macro-molecules, in the contours of islands and lakes, mountains and valleys, and clouds, in the distribution of species in an ecosystem such as the great Okefenokee Swamp, hears in the music of Bach and again sees, increasingly, in computer-generated art (Mandlebrot, 1977; Peterson, 1984a,b; Raloff, 1982; Science News, 1983, 1980; Thomsen, 1982,1980; Weisenburd, 1985).

The preceding are all examples of fractals expressed in natural material structures where the basic forms of materials—circle, spiral, meander and helix, branching patterns, and polygons (especially the hexagon)—predominate (Nova, 1985). We can expect systems of intelligence and culture to converge on these essentials and to produce fractals derivative of these and, subsequently, many less-probable structures. The music of Bach and computer-generated art provide two examples from known cultural systems. I have found the implicit structures and historical changes of design in Navajo rugs, ritual, sand paintings, and myth consistent in this respect (Riner, 1986). *Surely these principles are ubiquitous in systems built by sentients.*

And why is the ideal structure of Arunta kinship patterning never observed in fact? Because the facts, and the chances, of a material, entropic medium of expression intervene. As Mandlebrodt, the discoverer of fractals says, "[They are] randomness combined with self-interaction to a strong degree" (Peterson, 1984a). Wherever the pattern of an ideal and proper system rubs up against the constraints of smart, entropic, material reality we can expect to find a fractal (Weisenburd, 1985:279; Freilich, 1975:208-209). I wonder how many other fractal patterns may await discovery in dusty ethnographies?

The next formal system phenomenon that we can expect to find expressed in all cultural systems is decision trees[7]. These can result in elaborate expert systems for tasks as diverse as diagnosing illness in a patient, to parsing the structures of a language, classifying a botanical sample, prospecting for petroleum, or modeling the economic behavior of traditional Navajos in the contemporary market (Waldrop, 1985; Thompson and Thompson, 1985; Wood, p.c.). But all decision trees begin in someone's perception of difference, a drawing of a simple, usually binary, distinction within/among its fields of perceptions such as: light–dark, loud–soft, harsh–smooth, etc.…again and again and again in an expanding fractal field of the simple…usually 3-element, jointed branch, Y-kind of structure, aimed at reduction of ambiguity.

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7. This item of rhetoric, the one that drew the biggest laugh in the conference paper, I have preserved. Folklore in the academy says that big ideas come back every generation, every 20 to 25 years. That may be a fundamental insight into the Great Scheme of Things (GST). This one, GST—General Systems Theory—seems to be doing so as I revise.

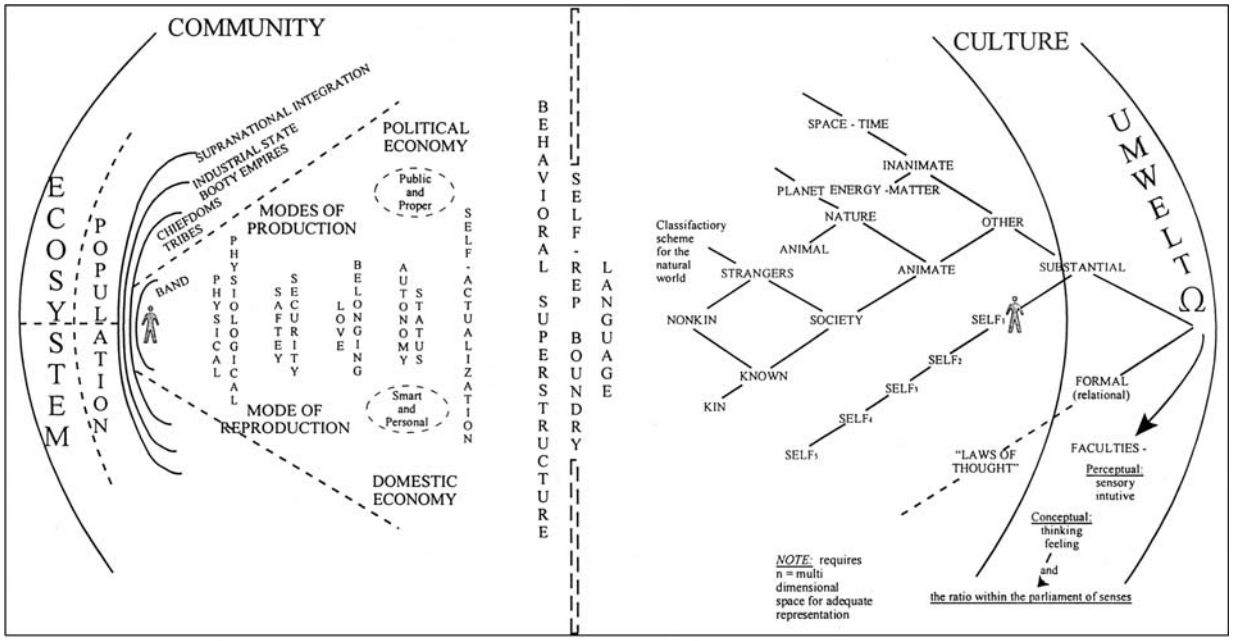

FIGURE 1: The Process of Transactive, Discriminative Mapping Vis-a-Vis the Sociocultural Environment.

As an example of a decision tree well documented in cultures, I offer Figure 1 that depicts the universals of human worldview (Kearney, 1984:65-89). In each instance of branching, I have identified the general nature of the distinction drawn there. For a number of reasons (e.g., making sense of spatio-temporal context, and intangibles such as relationships and causality; Kearney, 1984:89-107) it appears that human distinction-drawing goes off simultaneously in at least four or six more dimensions than the two that I can depict in Figure 1.

Examples of many more specific decision trees, some approaching the multidimensional complexity of semantic networks, characterize a tradition of anthropological research that spans work from the Voegelins' *Hopi Domains* (Voegelin and Voegelin, 1957) through the ethnoscience/ethnosemantic school of Frake, 1962; Werner and Schoepfle, 1987; Spradley, 1980, 1979, *and into the present*.

Finally we come to popping. This is moving one's focus of attention up one level of abstraction to the next in order to write or discover a meta-rule, or down one level in detail to specify procedures. Popping happens all the time in cultural systems, so much so that Marvin Harris has emphasized it in his central and strongest argument for "Why a Perfect Knowledge of All the Rules One Must Know to Act Like a Native Cannot Lead to the Knowledge of How Natives Act" (Harris, 1974). Harris' thesis, however, confounds how any human in any culture can always rationalize; that is, how one can always cite, invent, infer, or abduct a culturally acceptable rule for almost any behavior, no matter how deviant. This point is well made in Mary Douglas' essay "Jokes" (Douglas, 1975).

Popping to a meta-level is not anything more or less than the inverse or complement of embedding. And embedding, Minsky's "clause structures," is another variety of recursion (Hofstadter, 1979: 127-135). If our alien intelligence or culture does not exhibit this particular feature, embedding—and popping, then it probably isn't intelligent.

Let me try for some kind of closure.

Most people argue—shallowly, I believe—that sustained and mutually beneficial contact with aliens is improbable, probably impossible, and "more 'n likely" undesirable anyhow. I have accepted the opinion of cosmologists that the existence and likelihood of an encounter with aliens is probable—and probably equal to 1, equal to certainty.

I have presented ethnographic evidence, the cases of our own persistent CONTACT, also of potlatching, the Kula Ring and tri-ethnic symbiosis among sociocultural systems in Swat, that sustained and mutually beneficial multicultural contacts among communities of *Homo sapiens* have occurred, and that they have bridged some of the greatest differences in ways of thinking that we are able to document among human communities.

I've gone on to argue for a more formal substantiation of the contact hypothesis:

First, that *culture* (and by extension, or inclusion, *language)*, the indigenous problem-solving/organizing behaviors, and formulations of mind/ intelligence, may be legitimately and productively represented and investigated as if culture is a formal system, another specie of artificial intelligence.

Second, that artificial intelligence research provides convincing argument that these kinds of systems do have common properties—universals of process and universals of content.

Third, that these universals are manifest in small sets of rules, including recursive systems generating fractals, decision trees and expert systems, and popping up to new levels to write meta-rules, and down to subordinate levels to write specifications, among their resultant products.

Throughout I have assumed that these kinds of universals, these information-preserving transformations, are the necessary and sufficient foundation upon which sustained and mutually beneficial contact with aliens can be established.

To the extent that I have persuaded readers to this position, then: Viva CONTACT!

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