

Human Complex Systems

Mathematical Anthropology and Cultural Theory
(University of California, Los Angeles)

Year 2003

Paper 0703BNC

TOWARD A THEORY OF CULTURE AND ADAPTIVE POTENTIAL

Benjamin N. Colby
Department of Anthropology, University of California, Irvine, USA

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Abstract

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AND ADAPTIVE POTENTIAL ⁱ**

**BENJAMIN N. COLBY
EMERITUS PROFESSOR
DEPARTMENT OF ANTHROPOLOGY
UNIVERSITY OF CALIFORNIA, IRVINE
BNCOLBY@UCI.EDU**

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**MATHEMATICAL ANTHROPOLOGY AND CULTURAL THEORY:
AN INTERNATIONAL JOURNAL
ISSN 1544-5879**

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BENJAMIN N. COLBY
EMERITUS PROFESSOR
DEPARTMENT OF ANTHROPOLOGY
UNIVERSITY OF CALIFORNIA, IRVINE
bncolby@uci.edu

Abstract: The theory of culture commonly used in science and lay writings alike is inadequate for interdisciplinary research and cannot incorporate recent findings in the biological and behavioral sciences. Nor can the commonly used theory deal adequately with questions of cultural well-being and cultural pathology. Attempts to develop new theories of culture with epidemiological models and notions like memes have been limited in their usefulness. This paper suggests a new evolutionary approach that spans both the phenomenal and ideational worlds and speaks to questions of agency in cultural transmission. The main emphasis of the theory concerns adaptive potential with some preliminary measures of cultural well-being that predict physical and mental health. Adaptive potential theory can also be used to define modalities of interpersonal relationships. This latter application of the theory suggests areas of theoretical development and testing for future work.

The Inadequacy of Culture Theory for a Scientific Anthropology

The Received Theory of Culture

Anthropology as a discipline has experienced major changes in its theoretical and methodological landscape over the last few decades. Most visible in the late 1970's and the 1980's was the postmodern movement. Less visible but now quite strong has been a biological turn, which began around the same time with sociobiology's influence but gained momentum in the 1990's through studies of human evolution, human behavioral ecology, and suggestions of ways in which cognitive anthropology might benefit from interdisciplinary research in psychoneurology, evolutionary anthropology, and molecular anthropology.

The postmodern movement in anthropology was caught up with basic concerns of how culture should be conceptualized and studied and what descriptive tasks and responsibilities should engage ethnographers in the field.. The biological movement in anthropology began with an orientation toward theoretical developments outside anthropology proper but is developing its own biocultural approach. Both movements, however, have yet to resolve some fundamental

issues centering on the culture concept itself and how it relates to major developments and problems in the world at large. This review and the theoretical program it describes address both humanistic and scientific interests in seeking a resolution to the problems discussed.

In anthropology current dissatisfaction with the culture concept now amounts to a familiar litany. Culture, as conceptualized by Franz Boas, Bronislaw Malinowski, Ruth Benedict, and Alfred Kroeber, is treated as the equivalent of species in biology, a spurious natural-history theory of culture. In this view culture is bound in everyday language by the determiners “a” and “the.” Thus “a culture” is a single conceptual entity, however abstract it is sometimes regarded to be. It can have members and these members, in most essential respects, share the same cultural basis, at least at some implicitly hypothesized core level. In such a view culture is an integrated, coherent and bounded unit with a certain root homogeneity among all its members. At bottom it is a spurious natural history concept. This natural history view of culture is widespread among the general public as the dominant folk theory, or vernacular idea, of culture. It also continues to be the commonly received, though in some quarters strongly besieged, theory among a great many anthropologists.

Characterizations of this received theory were covered years ago in the extensive survey by Alfred Kroeber and Clyde Kluckhohn who concluded with an emphasis on the primacy of pattern and pattern relation yet where culture as a logical construct is not identified with any mode of actual behavior. “As yet,” they wrote, “We have no full theory of culture (1952 p. 181).” Kroeber was later to express dissatisfaction with their own attempt at a concluding synthesis.

A parallel between the notion of species and the received view of culture continues to mislead research even today. For example, a recent survey looks at the possibility of reconstructing cultural phylogenies. It asks the question of whether human cultures, or parts of them, are isolated from one another to the same degree as biological entities like species and genes (Boyd, et al. 1997, p. 356). That this natural history element of the received theory still has not been laid to rest is due in part to the very vagueness of the concept. Dan Sperber states, “It is not so much that anthropologists don’t share theoretical concepts; it is that they don’t have theoretical concepts of their own (1996 p. 16).”

Numerous critiques and revisions that seek to correct well-known deficiencies in culture theory have not succeeded in avoiding the culturalistic fallacy where culture is defined as an ideational abstraction and then reified into an ontological entity independent of its human producers (Bidney 1996 p. 51). Until recently there had been few improvements over Bidney’s own attempted solution characterized as integral culture, a science-accepting, humanistic version published during a time of relative theoretical calm in the discipline. Later, Keesing grouped definitions and theories of culture into adaptational and ideational clusters (1974). Both Keesing’s clusters and Bidney’s redefinitions of culture nevertheless remained within the received natural history view of culture as a discrete and bound phenomenon.

Among anthropologists, reactions to the inadequate conceptualization of culture range from avoiding the mention of culture, or more strongly, writing against culture (Abu-Lughod 1991;

Abu-Lughod 1999); to more draconian measures like rejecting science (Scheper-Hughes 1995); or outright nihilism (Shweder 1991). Many of these reactions are motivated by moral concerns ethnographers have found to be particularly compelling in the regions they have studied. Political oppression, commercial exploitation, gender discrimination, and racism bring these issues to the foreground. Too often, however, the solutions offered are set up in explicit opposition to empirical science which is viewed as an instrument of colonialism, capitalism, and other political interests.

Some New Approaches

A growing dissatisfaction with the received natural history view in all its variations and attempted improvements was to fuel the controversies that raged through the 1980's and the early 1990's. The emergence of epidemiological models of culture (Sperber 1985; 1996) has been an improvement, as are those oriented toward evolutionary explanations with epidemiological models as a starting point (Boyd and Richerson 1985; Cavalli-Sforza and Feldman 1981).

Interesting developments have also come from cognitive anthropology. This subfield which started out with much vigor especially in kinship terminology (Goodenough 1956; Lounsbury 1956) and taxonomic study (Berlin, et al. 1973; Berlin and Kay. 1969) did not capture mainstream social and cultural anthropology during a militant postmodern phase which has left the legacy of anti-science thinking among social anthropologists.

Not all this early work in cognitive anthropology was concerned with semantic classification and analysis. The use of distributional analysis to discern larger chunks of cognitive units in an overall structure or grammar (Colby 1973a; Colby 1973b; Colby 1975) and an analysis of Ixil divination (Colby in press; Colby and Colby 1981) were attempts at linking higher level cognitive units and operations in narrative grammars and decision models to major life events and concerns in a society.

Now with a new break-through in semantic analysis in which units of meaning are located in a multi-dimensional space that may link up with brain imaging, a key question in culture theory, the matter of culture sharing, is being addressed with important consequences for culture theory (Romney and Moore 1998). The age-old questions of whether particular units of culture exist and whether culture has a "skin" or boundary (Chick 2001) have thus come up again in the light of multidimensional scaling. A particularly cogent approach to these problems is to be found in a discussion by Handwerker (2002).

In this paper I propose a solution in terms of universal values, dispositions, and conditions that accommodate new studies of cognitively distributed cultural units such as those by Romney and his associates (Romney and Moore 1998; Romney and Moore 2001; Romney 1986), Read's recent modeling of the cultural process (Read 2001), Handwerker's construct validity approach to cultures (Handwerker 2002) and a growing number of others. Among these issues is whether culture is, or can be, a sufficiently integrating concept to unify the four traditional subfields of anthropology, biological, linguistic, archeological, and social; and whether new concepts and theories of culture can relate to findings in neighboring scientific fields, particularly

those that are undergoing an accelerating development like genetics, developmental psychology and psychoneurology.

Without an integrating concept of culture that relates to the more rapid progress in neighboring scientific fields there is an increasing fragmentation of subfields within anthropology as they move away from the core towards other disciplines that are more empirically and theoretically progressive. The reuniting of the four anthropological subfields is possible, however, if a culture theory can be developed in terms of universal values, dispositions, and conditions within a coevolutionary framework; i.e. a general evolutionary perspective that encompasses both natural selection and cultural transmission and the interaction between the two. Such a theory would not only serve to integrate anthropology, but would also relate better to the scientific disciplines that are increasingly relevant to the understanding of human life and culture.

Cultural Well-Being

Few new approaches to culture, however, have dealt head on with an issue that has to be addressed if a theory of culture is to speak to the problems of the new millennium, problems that have come to the fore with the world situation as it is developing today: Can a scientific approach to culture facilitate the assessment of cultural well-being and cultural pathology?

This question has, in fact, been addressed by earlier generations of empirically guided anthropologists committed to a scientific approach. Most noteworthy are the studies by Oscar Lewis of what he called the culture of poverty (1959; 1961; 1966). Later Raul Naroll addressed the issue from a perspective of cross-cultural study and social indicators (1969; 1983). More recently still, is Robert Edgerton's treatise on "Sick Societies" (1992). The list can be extended. Postulates concerning cultural components of a social separation syndrome as well as other kinds of stress leading to psychological, physiological and behavioral impairments have been presented by Appell (1991). Interest in sociocultural well-being and pathology is common in cross-cultural studies. The Whittings (1983) Munroes (1993; 1997), and Embers (Ember and Ember 1992; 1992), Rohner (1975; 1986) and other cross-cultural anthropologists are among those who have applied a hypothesis-testing approach in the discipline.

Yet there are scientifically oriented anthropologists who feel that the question of what constitutes the good society, or questions of universal morality, might interfere with scientific objectivity. These opinions are echoed by postmodernists who see science and studies of well-being and social justice as incompatible. Actually, scientists range along the full continuum from the view that science and morality are incompatible at one end to the view that they are not at the other. In commenting on such controversies D'Andrade takes a middle position when he argues for keeping empirical approaches separate but does not disallow a scientifically derived vision of what the good society and the good culture would look like (1995). I am convinced the key to this issue of science and cultural well-being goes back to the conventional view of culture, particularly its heavy emphasis on cultural relativism.

Cultural Relativism

Regarded as a unique Gestalt or configuration, each cultural system in the received view could only be understood in terms of itself. The focus thus was on contextualizing ethnographic description in terms of local cultural articulations rather than from an outside observer's viewpoint, an emphasis that was particularly acute in the early days of anthropology as a corrective to prejudiced views of those with missionary and colonial interests. Relativism reinforced the view that culture is independent of individuals and externally structured—especially in language, kinship and religion. In its most extreme form relativism would require ethnographers to assume the beliefs and practices of the people being described (Shweder 1991).

Clearly the whole issue of ethnographic understanding, objectivity, and relativism needs reexamining. As Gellner wrote, relativism took root in a world of culturally self-contained islands:

Our world, on the other hand, consists of an enormous number of unstable and, above all, overlapping cultural zones, and the conflicts or options within them cannot possibly be resolved by inviting those who face such options to consult, each of them, only the oracles of their own culture - because their cultures are endowed with multiple competing oracles. In fact, they do not in any sense have a single culture (Gellner 1998 p. 172).

A relativistic theory of culture is severely restricted at two levels. At the level of individual members of a culture (i.e. in terms of the received view of culture) one has trouble explaining the variations in knowledge and cognition that exist among them. At the level of the culture (again as viewed in terms of the received theory) one is unable to explain the change and the evolutionary processes culture so obviously undergoes except in terms of the death or migration of people who carry the culture with them.

The Locus of Culture

At either level, whether individual or cultural, the locus of culture is central to the foregoing problems. If culture is to have a boundary, as in the received view, a relativistic stance disallows a cognitively defined culture and a locus. When relativism is replaced by universalism where the culture of different societies can be compared in terms of characteristics that are equivalent regardless of local cultural variation, the unit of natural selection can be located in the individual and in individuals but how can such a locus relate to cultural institutions, languages, religions, economic roles and other characteristics? Further, nowadays research is so varied in purpose that culture is used in some piecemeal fashion. Indeed cultural groupings targeted for research can vary according to whatever cultural characteristics or trait relate to some practical purpose in the research.

Generally, however, there is a movement toward locating culture in the mind. Psychological anthropology has attended to the individual level in a variety of ways starting with Kardiner's notion of modal personality (1947). During that time psychology was conceptualized as distinct from culture, as reflected in the characterization of the subfield as culture and personality. Over the years since that time there has been an increase in the number of

psychologically oriented anthropologists. With it has come a trend toward locating culture as representations in the mind and noting how these representations are distributed differentially across a population or society (Roberts 1964; Schwartz 1978; 1989; 1992).

Locating culture within the individual is also part of Sperber's epidemiological approach (Sperber 1996). A mental locus is often assumed in linguistically oriented anthropology (1983; Agar 1983). Cognitive anthropology, virtually by definition, locates culture within the individual or the mind (Romney 1986). Elsewhere, though, a cognitively distributed view of culture has been resisted. Geertz opposes the idea of individual minds as a locus for culture in his general relativistic (1984) and anti-science (see Nader 1995) position, a strongly influential one in the discipline. If, contra Geertz, we do assume a mental locus of culture, however, we are still left with problems, particularly concerning culture transmission and coevolutionary processes in which natural selection and cultural selection interact.

Two Orders of Cultural Phenomena

Goodenough, a cognitive anthropologist, has characterized disagreement over just what culture is in terms of two orders, phenomenal and ideational (Goodenough 1996). He then argues that culture should be used only for the ideational order. Using the term "culture" indiscriminately for both realm, he argues, has muddied the theoretical waters:

That the phenomenal order is culturally structured goes without saying. But it is not culture in the same sense that the things people learn are culture, any more than the bridges, railroads, skyscrapers, and highways with which people now live are the same as the engineering knowledge—the culture engineering—that has produced them, or the symbolic value that they have acquired. It remains to be seen how anthropologists will resolve the terminological problem (Goodenough 1996 p. 296).

Sperber makes a similar distinction in his description of mental and public representations (1996). But the ideational route is not a solution if one takes Geertz's position on culture: "though ideational, it does not exist in someone's head; though unphysical, it is not an occult entity" (1973 p. 10). It is understandable that many archeologists and social anthropologists are reluctant to dismiss art, technology and economic institutions as culture if a distinction has to be made in favor of a mental locus for culture. What, then, are the advantages and disadvantages of doing so?

Sociobiology and Memes

One advantage of a mental locus for culture is the interdisciplinary connections made possible through it. Through new imaging techniques neurophysiology is making great strides in understanding how the human brain works and how language and tool-making may have developed (Deacon 1997; Lieberman 1998). These developments can act as a corrective to some of the earlier extrapolations from genetics to human behavior that regarded the brain as a black box driven more by genetic determinants than by human thinking and decision making. In the past numerous social anthropologists avoided sociobiological approaches because those approaches were seen to be overly deterministic explanations that denied the spontaneity and

agency of human life. Yet when sociobiologists point out the uncanny and often amusing parallels between specific human and infrahuman behaviors they are not denying human creativity or consciousness. Nor do such parallels involve a subscription to close one-to-one linkages between particular genes and culture except in narrow cases like lactose intolerance and the consumption of dairy products (van den Berghe 1987) or, presumably, fundamental genetic malfunctions that disable cultural development like Mongolism. With each new finding in genetics, however, the reality of biocultural interaction takes on a new complexity that beggars past debates over genetic determinism and indeed shifts the whole perspective away from such a simplistic duality of position. Nothing could be more fundamental to culture itself than the FOXP2 gene, still poorly understood but which is responsible for a protein that is somehow related to orofacial movement – the articulation of speech – and to various aspects of speech expression and reception. In sum, culture theory is bound to move away from former arguments rooted in personal or political predilections (in which relativism plays a strong role) toward issues rooted in the complexity of empirical findings. Thus findings in neurophysiology, developmental psychology, and genetics are bound to impact culture theory and ideas about human consciousness in ways as yet unanticipated. An interactive engagement among the four subfields of anthropology has much to contribute as will interdisciplinary research in the biological and psychological disciplines.

Thus the natural history theory of culture, already inadequate for much of the past century's anthropology, is being rendered over more obsolete by genetics and psychoneurology. Admittedly this spurious theory of culture is held more explicitly around the periphery of anthropology and in neighboring disciplines that draw on anthropology for culture theory, in the multiculturalism movements and among the public than it is held at the sociocultural core of the discipline. The problem at the core, however, is that no adequate substitute has taken its place. If one examines current writings the old view is still implicit, for example, in the use of culture as a count noun. Explicitly, culture theory at the core is now in turmoil, with the major challenge to the received theory coming from views of cognitively distributed culture. A less serious challenge (because it discounts human agency) comes from a meme-oriented view of culture (Dawkins 1982) which has gained little attention within mainstream social and cultural anthropology.

The meme view of culture, however, provides a useful lesson. It brings us to another difficulty, a holdover from earlier views in biology that information flow is unidirectional, from DNA on up (Falk and Jablonka 1997, p. 397). This tendency keeps a conservative "leash" (with apologies to E.O. Wilson) on biologists seeking to extend their purview to culture. Nowhere is the intellectual authority of this tendency appealed to more strongly than in Dawkins' mapping of cultural units or memes onto his notion of the selfish gene (Dawkins 1976). E.O. Wilson's recent publications appear to move away from this toward the recognition of the increasing extent to which environment and experience shapes the phenotype.

Actually, few hold to either the genetic deterministic extreme or to the culture as a *tabula rasa* extreme – there seems to be a sliding scale somewhere in between that in recent years has

been moving away from the genetic side towards the experiential/cultural side or alternatively conceptualized, the innate versus learned behavior side but then moves back again. As stated earlier, we need to get off that continuum and attend to empirical reality which is much more complex and interesting than this sliding scale which is powerfully maintained by an underlying modality I will characterize in a later section. The sliding scale still dominates debate and has been accentuated by the role of the virus metaphor in culture theory.

The Virus Metaphor versus Agency

Dawkins' use of the term, meme, as a unit of culture bypasses the strongly debated issue of innate versus learned behavior. He does this by attributing to genes, if only metaphorically, the very autonomy or agency he seems to deny humans (Dawkins 1976). A meme can infect the mind, or jump from one mind to another. People thus can welcome or resist these infections but the metaphoric initiative is on the side of the meme, not the person. Dennett, a philosopher memologist, uses the phrase, meme-infested brains (Dennett 1996). This is an unfortunate metaphor. It obscures the interactive, agentic nature of human action and decision making. Indeed it obscures all processes of cultural transmission except for the physical movement or demise of people as carriers of culture.

Social and linguistic anthropologists are the first to detail the ways metaphors constrain thought and express agendas (Fernandez 1974; Lakoff and Turner 1989; Quinn 1981). Indeed biologists, social scientists, and historians of science caution against the constitutive impact that analogies have on the formation of concepts, particularly concerning inheritance and genetics (Hejl, et al. 1997, p. 387). Except for infrequent biological (Deacon 1997; Durham 1991) and epidemiological usage in anthropology (and then only in a most general, non-empirically-rooted manner) the virus metaphor is not generally found within the discipline.

The virus metaphor is attractive to meme theorists in part because it supports the notion of replication and renders culture transmission unrealistically free of complexity. In the exuberance of earlier writings, though perhaps no longer today, something as broad and complex as altruistic behavior was reduced to a single meme or gene which ultimately was, if only metaphorically, selfish rather than altruistic in the sense of replicating genes. With the shift toward phenotypes where environment and experience figure as well as genetics, one can gain some distance from the genetically deterministic trap. The meme-as-virus approach, however, is a throwback, at least metaphorically, to the earlier more exclusively genetic viewpoint. Much of the meme argumentation involves an appeal to the authority of gene research. But that research itself is experiencing rapid revision. Dawkins assumes that DNA is a passive and exclusive carrier of heritable biological information when the more recent evidence indicates otherwise.

In sum, the meme-as-virus theory is a simplified view of humans as passive receptacles for meme infestations. In this view the mind remains unlinked to actual ethnographic data. The main issue remains as one of agency (Aunger 2000).

While scientific investigations often have to deliberately oversimplify, or reduce phenomena to bare essentials to set up hypotheses and get on with the investigation at hand, the

simplification offered by the virus concept is not helpful. Meme-as-virus theory ignores studies showing the importance of variables like brain architecture (Deacon 1997), relationships between behavior and ecology (Borgerhoff Mulder 1991; Cavalli-Sforza and Cavalli-Sforza 1995; Steward 1955), origins of ritual behavior, art, and language (Dunbar, et al. 1999), kinds of social organization and inheritance systems (Hejl, et al. 1997), and methods of conflict resolution both within and between groups (Ember and Ember 1994; Kelly 1985; Nader and Todd 1978).

Furthermore, social and linguistic anthropologists are especially sensitive to the need for the validation of basic cognitive units. In linguistics the designation of phonemes and morphemes as basic units has long been a standard objective of distributional analysis. In cognitive anthropology and ethnoscience there have been carefully developed procedures for designating semantic units (Metzger and Williams 1963a; Metzger and Williams 1963b; Werner and Schoepfle 1987). In some kinds of discourse study the use of distributional analysis in interaction with a grammar of higher level categories has identified discrete units (eidons) as elements of narrative grammar (Colby 1973a; Colby 1973b; Colby 1975). No such procedures have been developed in meme-as-virus theory.

Another factor vitiating the viability of meme-as-viruses is their lack of internal structures that would lead to a typology, a criticism made by Romney and Moore (Romney and Moore 2001). In short, there is no empirical basis for such units as part of a viable theoretical program.

A Pattern/Schema Tandem Theory of Culture

Imre Lakatos argues that ideally a research program goes beyond simple tests of single theoretical statements that are falsifiable to a series of statements, tests, exploratory processes and theoretical revisions. The crucial element in this wider program is whether the program is progressive or degenerating. It is progressive if each revised theory has “excess empirical content” over the earlier theories in the program and that the revised theory is corroborated in new tests (Lakatos 1970). By “revised” Lakatos meant a continuity from one theoretical statement to its revision but with overly severe restrictions criticized by Suppe (Suppe 1977).

If we eliminate those restrictions, what, then, might a viable program of culture theory be? The remainder of this paper offers some suggestions. If we are to develop a useful alternative to the received natural history theory of culture or an alternative to false solutions to the problems entailed by the received theory, it will require a broad theoretical program rooted in human coevolutionary processes, especially culture transmission. Such a program would need a theoretical base of assumptions concerning cultural phenomena that avoid the problems discussed so far.

In the model presented here the variable of adaptive potential is explored with reference to biocultural success, the outcome of coevolutionary processes, paralleling at a higher level of generality the lower level concepts of biological success and natural selection but also including culture transmission. At this higher level of generalization one can thus speak of coevolutionary processes, including epigenetic phenomena occurring through both development

and ecological interaction. These mechanisms should fit with current understandings in cross-cultural studies, evolutionary anthropology, behavioral ecology, cognitive anthropology, developmental psychology and neuropsychology. Indeed, they should facilitate the reintegration of social anthropology with all four subfields in the discipline and provide a viable theory of culture that other sciences can refer to in their interdisciplinary studies.

Spanning the Phenomenal and Ideational Worlds

A research program that fully recognizes human agency in a coevolutionary process must encompass both ideational and phenomenal culture. John Searle's distinction between brute facts and institutional facts (1995) can be a starting point for how this might be accomplished. For Searle, brute facts constitute phenomena that are independent of our perceptions while institutional facts are essentially ideational. They require human institutions (i.e. culture in his usage) for their existence.

Thus there are no institutional facts without brute facts. For example, pieces of paper with numbers, "Federal Reserve Note," and other words, designs and pictures printed on them are called money. These pieces of paper have a value and denomination determined by the US Treasury Department. The brute, or phenomenal, fact is that the object in question is a piece of paper with ink on it. The institutional, or ideational, fact is the functional use of this object as money (Searle 1995).

Markings on the paper as perceived by human observers are ideational cultural patterns. Certain arrangements of the markings are recognized as relevant to financial transactions, while other markings, perhaps some smudges, are considered as irrelevant. A bank teller may assign relevance to the smudge in the task of retiring deficient bills from circulation but the teller is nevertheless attending to the same financial pattern by maintaining its recognition as a pattern. In this case the brute fact, the piece of paper with markings, is the vehicle for the pattern. If the vehicle is torn, frayed, or smudged, it is less useful as a pattern vehicle because the information has been corrupted by "noise."

Next, consider a different kind of pattern. A devout Muslim interrupts his daily work to bow towards Mecca and recite a prayer. The movements and attitudes of the body are also phenomenal, brute facts, as are the sound waves produced by the prayer. Here the cultural patterns involved are to be seen in behavior and the person being observed is an agentive carrier of the means to produce those patterns. A similar distinction has been useful in semiotic studies that distinguish meaning from text or in the study of laws and how they are variously interpreted in a society (Hejl 1997; Nader 1997). What we have, then, are processes that concern both the phenomenal and ideational orders.

Locating culture exclusively in the mind might preclude basic mechanisms of natural selection thus losing the interest of most biological or ecological anthropologists. When artifacts are left out of the cultural mix, be they paper money, cowry shells or buildings, we lose the archeologists. These subfields are part of anthropology because of their common focus on human evolution and history. Culture is the bond that holds them together. Clearly a viable

program of culture theory cannot treat culture as exclusively ideational, nor can it treat cognitive processes as unconnected to the material or biophysical realm.

The fact that mental representations are not directly observable should not preclude anthropologists from determining a viable approximation to how they might be organized into interacting chunks of information within the brain. One simply analyzes the patterns observed in what people say or write. This can be done through the distributional analysis of sufficiently large samples of cultural productions, particularly in narrative (Colby 1973a; Colby 1975; Colby 1989b) and decision processing systems like calendrical divination (Colby in press; Colby and Colby 1981). Linguists have been doing this all along with phonemic and morphemic analyses. Representations that are in the mind can be inferred from speech patterns observed and noted as regularities in the external world (as spoken or written text). They are cultural to the extent that they match or produce cultural patterns. They are ecological or natural to the extent that they match recognizable patterns in the natural world.¹

There already is a tradition in thinking about this process. Jerome Bruner's insights concerning learning and education (1996) is in this spirit as is the approach of Michael Cole (2000) whose cultural psychology takes its departure from the Russian emphasis on the use of tools or artifacts as mediating mental development. Based in Marx Wartofsky's three levels of artifacts - those directly used in production, those that represent the primary artifacts, and more abstract imaginative artifacts that influence our world view (as cited by Cole 1996; Wartofsky 1979), Cole develops a notion of artifact mediation. A key element of this approach is to regard schemas as selection mechanisms that separate situationally significant elements from insignificant ones. Cole then designates artifacts as the fundamental constituents of culture

¹ My interpretation of Searle's distinction has a different consequence from that suggested by Romney and Moore. They write that the semantic domain of animals "is a representation of the culture" (Romney, A Kimball, and Carmella C. Moore 1998 *Toward a theory of culture as shared cognitive structures*. *Ethos* 26(3):314-337.). In contrast, I would link the animal domain with natural kinds and would not consider it to be a cultural representation (though as a language label it is, and an animal is often cognitively linked with cultural accoutrements). We may find that the cognitively resident component of abstract culture is primarily located in one part of the brain, probably the forebrain or prefrontal cortex while what are primarily perceptual representations are located elsewhere, as Romney and Moore suggest, in the visual and motor areas (p 332). For expositional purposes, I suspect (rather than for theoretical argumentation), Romney and Moore still follow an implicit received view of culture. For example they write that the locus of culture "resides in the minds of the members of the culture." The question then shifts to "membership" in a culture, which implies boundaries or "skin" for that culture. This view is complicated, however, by their position on universal culture as concrete versus localized culture as abstract. Presumably they would define membership in "a" culture semantically, for example, those sharing a similar cognitive structure for kin terms. Dialectology mappings of morpheme isoglosses, however, suggests that problems of drawing linguistic lines are magnified much more in areas of abstract semantics. Actually, the consensus approach of Romney and his colleagues is likely to contribute substantially to a major revision of the received view of culture but they have yet to map out all of the theoretical consequences of their most remarkable findings. For now, we may have to distinguish between colloquial usage of the word, culture (continuing in the received view) and a theoretical view (encompassing a cognitive theory or the pattern/schema tandem conceptualization argued for in this section).

reserving the ideational side for the psychological processes he wishes to explain through cultural mediation.

A similar distinction in anthropology has been made in terms of an operational versus cognized environment (Laughlin, et al. 1990). The former, like Searle's brute facts, is independent of human knowledge or its representation; the latter is what goes on inside our heads. This distinction is the basis for Winkelman's theory of shamanism, an ancient role that must have figured importantly in the coevolution of human biology and culture (Winkelman 2000). A related distinction is made by Dwight Read who distinguishes between formal models of the logic of cultural constructs and the logic of the instantiation of the symbolic/abstract elements of those cultural constructs (Read 2001). Another approach to the tandem nature of cultural processes is the work of Barry Hewlett (1995) and his colleagues (1986; 2000). Their approach emphasizes the inclusion in schemas of emotional or visceral relations to thought (which usually were excluded in the early days of cognitive schemas and largely excluded even today). This emphasis on total body is more in keeping with an integrative anthropology. As Antonio Damasio has so well demonstrated, it is also crucial to an understanding of any kind of thought and consciousness (Damasio 1994; Damasio 1999).

Another tandem approach (Hejl, et al. 1997) has been advanced in a human biological, evolutionary theory that argues against two earlier theoretical writings (Cavalli-Sforza and Feldman 1981; Richerson and Boyd 1989) for their views of transmission in a single channel without modification. The new approach conceptualizes an event (genotype or message) as being processed through an interactive system that includes individuals as organisms and as participants in a social system which takes place in a physical and social environment. The event is processed through this system to its effect (phenotype, meaning). Viewed in such a multi-leveled, multi-systemic context the opposition between evolution and development fades and more attention is given to self-organizing networks and multiple inheritance systems.

Cultural patterns are thus perceived to reside in a physical phenomenon, be it human action, sound waves of speech, or physical object. The pattern is not the artifact or behavior itself. A pattern consists, rather, of those properties of the phenomenon or brute fact being noted which are perceptually represented and processed in the observer's brain as meaningful. In short, the minute some behavior or artifact is perceived by someone other than the originator of that behavior or artifact, it becomes an element of shared culture. It is shared by means of the matching schema for that pattern that is constructed in the brain of the perceiver. Cultural patterns as perceived through schemas represent the cultural reality that originates in human action by others. This matching is thus a tandem processes. It guides both perceptual and effector operations in a system involving human nature and culture, experience and history, expression and audience.

While this pattern/schema theory differentiates externally observed patterns from internally held schemas, the dividing line is not at the surface of the eye, but internally somewhere during the early processing of sensory information in all the sensory modalities. In visual perception, the eyes focus on a pattern observed in the environment. The pattern may be

either a cultural or a natural pattern. There are various reflexive actions that occur at this level, such as a movement of the high-resolution central part of the retina to follow some motion or change relating to the pattern being scanned. The scanning process can be guided by schemas developed from earlier experiences that shape epigenetic predispositions and fill out schema scaffolds. If criterial or nonaccidental properties of an object's pattern are missing, the eyes are prompted to search further (Lowe 1985). This scanning perception goes to a visual buffer, which in some of the visual areas are retinotopically organized. That is, the pattern seen is physically represented in the brain, as has been demonstrated and even photographed in the remarkable study by Tootell and his associates (Tootell, et al. 1982).² Topographical mapping is well established for both vision and audition. The cortical boundaries of higher associations are not so clear.

Agency and the Sharing of Cultural Patterns

The most serious problem in earlier conceptions of culture has been an inadequate explanation of the transmission and sharing of culture. In the meme-as-virus view, for instance, the mind is essentially a black box infested by memes. This black box is partially opened by the Santa Barbara school of evolutionary psychology in that the mind is represented by many modules which are genetically geared to deal with particular tasks, much like Chomsky originally postulated to be a predetermined language acquisition device, or LAD. This, however, simply pushes the black box approach back to a series of smaller black boxes which were likened to a set of computers (Cosmides and Tooby 1997) but without internal specification or linkage to observed cultural patterns. Further, this exclusive fitness branch of evolutionary psychology is itself frozen in a 1970's sociobiology and is too narrow to serve a unifying theoretical role (Caporael 2001). One way out of this box conceptualization is through a hierarchical or multi-level conceptualization (Borgerhoff Mulder, et al. 1997; Caporael 1997). A pattern/schema approach similarly allows hierarchies and systemic multi-level-recursive networks to work without genetically rigid specific-purpose modules.

At a very low level of generality no two people have identical neurological wiring; and since their experiences and histories can never be identical, their neural connections can never be identical. Yet in language their neural networks were trained by expression patterns following a widely shared language grammar. Thus in language, involving a symbolic mapping of reality and thought, as it does, grammar gives unity across linguistic activity (within any speech community)

² Tootell's group showed that neuroanatomical imaging with radioactive metabolic tracers in animals revealed activated neurons that took on the same spatial arrangement as the observed pattern. In these maps (in certain layers of the visual cortex) edges, regions of color and texture and relative distances are clearly visible. Romney and Moore Ibid. argue that Tootell's finding supports the idea that the patterns they map out through similarity judgments reveal the neural location of the terms, or morphemes, studied (presumably from the first three dimensions of their analysis). One would expect the actual meaning of the morphemes (as opposed to the location of the morphemes themselves) to involve extensions to other regions of the brain

despite differences in neurological wiring and experiences. The sharing of cultural schemas thus is a matter of at least three things: First the level of cognitive organization, with very specific lowest levels being idiosyncratically networked neurologically. Second is the frequency with which patterns are produced by schemas (for example, language is high frequency and thus widely shared). Third and finally, the degree to which some behavior is restricted by role or specialization in a group.

The cut-off point or level of delicacy in which schemas in the same language or cultural system are equivalent among individuals is an empirical and obviously highly complex question. Romney's work (1999), studies by Weller (2001; 1990), Berlin (1992) and Werner (Werner 1981; Werner, et al. 1986; Werner, et al. 1983), and other cognitive anthropologists are focusing increasingly on this question of sharing. Clearly, since speech patterns are sufficiently similar for pattern recognition and communication within a language community the schemas that produce and recognize them must obviously be similar or functionally equivalent. Mapping this out through brain imagery techniques will have a direct bearing on a pattern/schema theory of culture. Other matters of significance is the sharing of validity claims of propositional truth, normative appropriation, and subjective sincerity (Habermas 1979; Habermas 1984; Habermas 1987) all required to facilitate successful communication.

The interaction between cultural patterns and schemas is never an isolated one-to-one process. Cultural processes are interactively systemic both within individuals and with the wider cultural, social and natural ecology. Individuals utilize systems of interactive dispositions, symbols and knowledge that best fit their own internal phenotype, experience and history. The dispositions are combined in an expressive ethos (Bateson 1965) and are further channeled, along with decisional processes and effects, through institutional systems (Malinowski 1960). These processes can be modeled through techniques used in artificial intelligence (Colby and Colby 1981).

People are both agents as well as subjects in their behavior. One's sense of self and identity involves a continuous dynamic self-monitoring and social negotiation that involve combinations of new constructions with traditional ideas (Bakhtin, et al. 1993) interactions between mind and artifact (Vygotsky 1962; Vygotsky 1978) and interplays of identity with agency (Holland 1998).

Cultural systems involve fluid networks of interacting individuals (Freeman et al 1999; (White and Johansen In press) who are at one and the same time culture pattern vehicles and cultural pattern observers. They are creators and decision makers in the production of cultural patterns, interacting with the results of their own labors in the built and planted settings in the environment which, in turn, contain the material vehicular source (books, written materials, machines, buildings, etc.) of cultural patterns.

In this dynamic process agency manifests itself at different levels of consciousness. The observation and adoption of some new behavioral pattern can range from almost automatic to

highly self-conscious. In either case it is engaged to some degree with goals and values that relate to success and well-being.³

The Coevolution of Natural Selection, Cultural Selection and Cultural Transmission

One reason the dynamics of culture transmission has failed to capture mainstream ethnographic attention is the failure to make a theoretical connection between proximate and distal processes of change and evolution in human life. Theory should connect well-being, which involve proximate process of natural and cultural selection, particularly those concerning physiological and mental health, to the distal processes which are so dominant in biological theories of evolution. This has, in fact, been done by ethologists in studies of infrahuman animal behavior. Ethological studies have focused not only on proximate processes of feeding, predator avoidance, mating, and raising young, but also on how animals gain attachments and orientations, and adapt to new situations (Hendrichs 1997).

It is in the study of proximate effects among humans that the gulf between three anthropological orientations Adam Kuper characterizes as Durkheimian, Boasian, and Darwinian (1994; 1999a; 1999b) can be most effectively bridged. This becomes possible through a new Darwinian basis that looks at concerns treated by Durkheim and Boas in terms of proximate mechanisms of adaptation and adaptive potential – close, in some respects, to Malinowski's functional approach. The new Darwinian basis has a modern twist: an assessment of physical and mental health as they relate to cultural functions. To attain such a perspective, however, requires a clearing out of some current evolutionary approaches that are counterproductive to such an approach.

Dawkin's meme and gene-centered view of evolution, while attractive to many lay people or non-anthropologists, is the most visible of these counterproductive theories. It is outdated by the increasing recognition of the roles ecology, culture, and life history have in shaping the human phenotype. Dawkin's view is based on earlier work (Williams 1966), which set the tone for a limited adaptationist approach that argued against group selection. Denying that altruism could emerge from non-kin-based pattern/schema interactions as opposed to some internally sensed but non-calculated kin selection (where altruism is acknowledged only with close degrees of genetic relationship) precluded a coevolutionary dynamic that could account for culture transmission. Unless culture transmission is extended to the major arena of pattern/schema interaction and ethnography, it is limited to the demographics of cultural carriers but, as such, has little interest for many social anthropologists.

The beginning of change in biological evolutionary theory was marked by the spandrels paper by Stephen Gould and Richard Lewontin (1979; see also Selzer 1993) which attacked the old adaptationist approach in favor of a new pluralistic or post-spandrel adaptationism (Rose and Lauder 1996). The idea that selection acts at many levels is more congenial to

³ The feeling of well-being need not be limited to conscious awareness in humans. Indeed even among infrahuman mammals physiological and emotional reactions lead to, and are guided by, well-being sensitivities Hendrichs, Hubert 1997.

ethnographic level studies. Later, Williams himself modified his earlier stance against the possibility of group selection on the basis of new evidence in evolutionary parasitology and female-biased sex ratios (Sober and Wilson 1998). As new theories utilize a more sophisticated understanding of human behavior and culture, group selection is given a more important role (Boyd and Richerson 1985).

Other developments within biology have also undermined the older view. Previously, evolution through natural selection was seen to involve two steps. The first is the origination of genetic change, usually described as blind or random variation. The second is selection for that change through the environmental situation (Mayr 1988 p 97-98). New biological theory, however, recognizes that variation in the genome occurs through more processes than were previously considered. Some of them are internally generated, self-organized, and emergent; quite different from the random genetic change through mutation or the recombination of chromosomes during meiosis. Others depend upon intercellular and external environmental interactions during an organism's development and aging. Among the newer theories and discussions of change in genomic material and inheritance are those of symbiosis (Margulis 1970), creative emergence (Goodwin 1994 p. xii; Rose 1997) and chaos theory (Kauffman 1993; Kauffman 1995). One thus needs to interpose additional processes between random genetic mutation and selection and give a greater role to the ecology of embryology and growth. Among these processes are epigenetic inheritance systems and the receptiveness of DNA to adaptive evolutionary changes through environmental interactions during growth of the organism (Falk and Jablonka 1997). Perhaps the most dramatic developments in genetic research, are those arising from studies in the new field of molecular anthropology. The focus here has been on mitochondrial (mt)DNA (inherited through the female line) and the light it can throw on human population movements much further back than anthropologists ever thought would be possible. Douglas Wallace's discovery of some 20 mitochondrial lineages for *Homo sapiens* is a major anthropological development as is his dual approach to mtDNA defects as (1) clues to future disease probabilities and (2) clues to past prehistorical human population movements (Mishmar D 2003; Wallace 2001).

In contrast to the traditional view of the first step in natural selection, which the newer view recognizes as only partially random, culture transmission is never a random process. It is always agentive since the perception of cultural patterns is by people whose actions stem from a chain of events and situations that, at least at some points in that chain, were due to their choosing (consciously or unconsciously). The first step in cultural selection, the origination step, is a reconstructive or creative process, not a random one.

Recent theorizing about the origination of genetic change has by-passed any focus on the first step of natural selection (i.e. a genetic change) and thus has clouded the issue for social anthropologists by shifting almost all attention to the second step, natural selection proper. Such a truncated model of biological evolution therefore bypasses the key difference between cultural selection through the natural selection of culture producers on the one hand, and culture transmission among producers (where agency rules), on the other. Further, Wallace's studies of

aging-related disease arising out of mitochondrial deficiencies which do not become evident until late in the aging process (e.g. cancer, diabetes) will eventually have an enormous impact on coevolutionary theory once that theory moves beyond the stumbling blocks of cultural input to factor in the deletions and mutations of the mitochondria that affect longevity but that may bear little relation to cultural characteristics associated with general well-being and happiness among individuals and societies.

The Origination of Cultural Patterns

In Elliott Sober's and David Sloan Wilson's interesting treatment of multilevel group selection theory (1998) the line that separates the natural selection of groups from culture transmission is not emphasized. This has the effect of minimizing the problem of origination. Even if the first step of biological evolution is not entirely random in the old sense, there is an enormous difference between the originating step in biological evolution and the originating step in culture transmission. While origination in culture transmission may involve unconscious neural processing, as well as conscious decision making, those unconscious processes are not random. Contrary to Sober and Wilson (1998, p. 153) if some changes came through visions from smoking a powerful weed they still would not be random as they usually are in natural selection.

Culture transmission starts out with what for the individual is an internal decision. Such a decision utilizes existing schemas in various degrees of reconstructive creativity. Three steps are involved: integration, expression, and observation.

First, there has to be an idea, plan or intention that has the potential of being expressed and transmitted as a cultural phenomenon. The integration step is entirely endosomatic, that is, internal to the mind and not yet communicated to others. It includes the prospective internal reinforcement of a plan, whether consciously foreseen or emotionally anticipated. It can be a creative playing out of possibilities, presumably a process that recruits integration in the pre-frontal cortex, that part of the brain most developed since the early hominids and which is linked with planning and forethought (Deacon 1997). This first step is a conscious and creative step of judgment and decision (Damasio 1994; Damasio 1999).

After integration comes a second step of expression, the manifestation of the idea or plan through action in the exosomatic environment. This can be the actual words uttered, bodily movements executed, or combinations of the two, along with their results, be they the hunting of game, gathering of harvests or making of tools.

Following expression is the third step, observation. The expression of a cultural pattern must be observed and recognized by one or more persons. It is not necessary for observers to reproduce the observed behavior or offer their own expressions in response. What matters is their matching of the pattern with their own schemas. This matching is initially a constructive, and hence creative, process. In this third step, then, culture is not replicated; it is reconstructed. The pattern matching process involves the creative construction of, and accommodation to, observed patterns.

In culture transmission the third step turns the first integration step of creative thought or decision and the second step of expression into a cultural process. All three steps involve

motivation and values that relate to social position, prestige, self-esteem, economic and political power, conflict, family safety, and religious beliefs to name but a few. Perhaps it is this Pandora's Box of decisional motivations that memologists and black box theorists seek to avoid by disregarding human agency. But it is precisely the orchestration of these complexities that occupies the attention of ethnographic work in social anthropology. The theoretical model, described in a later section, moves from descriptive accounts of this orchestration to a predictive statement focusing on what motivates and channels culture transmission. In a pattern/schema theory cultural transmission takes on a more specified meaning than in the past. Cultural transmission requires one or more producers, P, and one or more observers, O, where the set P does not intersect with the set O. Cultural transmission thus takes place where a culture pattern produced by P is matched by schemas constructed by O. That construction process may utilize comparable areas in the brain of P and O, but the actual neural networking would certainly include nodes of connection that reflect unique experiences for the originator and reconstructor of some cultural element.

Proximate Effects in Human Evolution

The flip side of the well-being dynamic of success striving is the avoidance of stress and the innumerable ways individuals and groups try to cope with stressors, many of which are at a subconscious level. Sometimes there is an actual seeking out of stress in some buffered fashion, as with war movies, horror stories, and war news; or unbuffered with sky diving and bungee jumping. This may possibly have a hormesis effect for some who actually seek stress activation (e.g. sensation seekers – (Zuckerman 1983; Zuckerman 1990) while others are overly sensitive to even small amounts of stress. With the exception of Dressler's research (1980; Dressler 1991; Dressler, et al. 1998) and the studies cited below, coping processes have usually been neglected in cultural anthropology. The enormously rich fields of behavioral medicine and health psychology have scarcely been tapped for culture theory, yet culture is a crucial component in this area (Aldwin 2000).

Patterns for avoiding and coping with stressors and conversely for achieving success and well-being vary by cultural group (Browner, et al. 1988; Graves and Graves 1985; Graves, et al. 1983; Rubel 1984). Yet there has to be a kernel of universality which links ultimately to natural selection. Here again is where the received relativistic view of culture is so limiting. A systemic view of culture must link to basic processes of natural selection and cultural evolution but at the same time must account for local differences between cultural groupings of individuals. A non-relativistic, systemic view accommodates both local variations and universal human characteristics in the transmission process. It is precisely in this connection to culture change and evolution and their coevolutionary interaction that the possibility to generate falsifiable statements about cultural phenomena shows the most promise.

Stress is the primary proximal effect and fulcrum point in this theoretical program. Stress, or its avoidance, profoundly affects short-term bodily conditions and feelings. One of the main stress effects comes through the much-studied hypothalamic-pituitary-adrenal (HPA) axis, a neurophysiological routing that releases cortisol, catecholamines and other stress hormones

when an individual is faced with a stressor. Stress mechanisms, in turn, can impair immune functioning and have other deleterious effects when stress hormone levels are high or chronically elevated.

The major motivating dispositions combine stress-avoiding goals with success seeking ones. Chief among these primordial goals for the social primates are those relating to social support and social position (Sapolsky 1992; Sapolsky 1998). Among baboons Robert Sapolsky measured levels of cortisol in individuals occupying different positions in the troop's dominance hierarchy before and after fights and challenges (Sapolsky 1992). He found that the bodily costs of positional changes in the dominance hierarchy are significant. With the increasing role of culture, goals of stress avoidance and social support become infinitely more complex though still amenable to analysis. Carolyn Aldwin's work in the normative aging study of Boston has examined social support and other coping effects among humans (Aldwin and Levenson 2001; Aldwin 2000). She has found both psychological and cultural aspects of social support to have a strong influence on health and longevity. Much of the research in health psychology shows the strength of social support in maintaining health as well as the adverse effects of its lack and the lack of social prestige in causing vulnerability to disease. In studies of human stressors William Dressler has found a biological relationship between social class-related aspirations and blood pressure, that, as with non-human primates in a dominance hierarchy, can take its toll on the body (Dressler 1991). Discrepancies between desired and actual dominance position (in this human case socioeconomic status and power) is most readily observed through changes in blood pressure. More recently he and Binden, using Romney's consensus methodology (Romney 1999), have refined their explanation in terms of cultural consonance. Success in maintaining high cultural conformity or consonance to a cultural model of success (primarily in the biophysical or material realm) makes for lower blood pressure as long as there is also high kin support (Dressler and Bindon 2000)

To be sure group solidarity through rituals and other group activities has distal as well as proximal effects. Over the millions of years in which solidarity groups may have been formed, the disposition to seek solidarity and maintain it (even if the groups themselves dissolve, reform and vary in many ways over the generations) clearly has undergone a selection process that involves the interaction between natural selection and cultural selection (i.e. coevolution) to develop dispositions toward the maintenance of solidarity.

Theories of natural selection center on survival and reproduction and in so doing often overlook the connection between survival and proximate processes of everyday life, processes that can raise or lower the probabilities of reaching an advanced age from moment to moment. By showing how stress and autonomic reactions endemic in a society link to cultural patterns like religion and to expressed ideas about success and well-being, there is an opportunity to formulate testable hypotheses that relate directly to culture theory, thus moving anthropology out of its primarily descriptive approach toward cumulative theory based on empirical findings.

Human Values and Homeostatic Regulation

Opinions about what is desirable in life surely have existed since the earliest development of culture. In the high civilizations they have been the subject of extensive religious codification in Egyptian, Vedic, Chinese, Greek, Judaic, Mayan, Aztec and other early traditions. More systematically they have been the subject of analysis in Aristotle's *Nicomachean Ethics* and *Rhetoric* where the notion of natural right influenced subsequent Western thinkers, most notably in Darwin's view of a natural moral sense (Arnhart 1998; Maienschein and Ruse 1999). This tradition of ethical naturalism assumes dispositions that one might now speculate as having developed through individual and group selection and culture transmission. Whether such is the case is still in dispute and is a matter for empirical analysis.

The testing of such a possibility would require an understanding of how the local cultural data tap into universal human needs. In both universal and local aspects of culture there has to be a flexibility, a capacity to respond to widely disparate situations. This flexibility extends to the autonomic nervous system and connected stressor responding systems that regulate cortisol and the catecholamines, (Cannon 1929; Sapolsky 1998). Human bodies and cultural systems alike accommodate to the autonomic nervous system as it works along a continuum from a defensive, hunkered down mode at one end to a less defensive, more expansive, and often exploratory, mode at the other (D'Aquili and Newberg 1999; Newberg, et al. 2001). The two extremes are aimed at two kinds of survival: immediate survival through sympathetic arousal, and long-term survival through a non-threatened parasympathetic state. Under stress immunological, digestive and other functions (where the mouth goes dry, digestion slows down, immunological function is reduced and the body concentrates on rapid buildup of energy for a quick physical response) have to be given lower priority than muscle readiness and perceptual alertness.

In the brain chronic sympathetic arousal is likely to activate deeper level, less rational, probably epigenetic, defense mechanisms in the service of the self system (self image, social images, sense of identity). These mechanisms include projection where the stressor source is attributed to others rather than to events or situations that may have been brought on by the self. When those others are outside one's own reference group Sober and Wilson refer to the dark side of altruism, where an altruistic act toward one group or person is at the expense of those perceived to be outsiders (Sober 1999; Sober and Wilson 1998). The darker defenses may promote solidarity of the reference group by building sociocultural boundaries. However open modes of thought and closed, defensive modes may both lead to altruism in the group. Yet when the defensive mode predominates, in addition to the differential treatment of people existing outside social boundaries there seems to be a lesser degree of altruistic behavior even within the group (Rohner 1975; Rohner 1986). So group selection can work both ways. A defensive mode may promote solidarity, but at the expense of an overall higher warmth (affiliative) dimension, despite the kind of bonding that may take place between fellow warriors against a common enemy. Further, a defensive mode may curtail conditions favoring creativity. Obviously there must be great variation in how this plays out in reality – an empirical question rarely addressed by anthropologists with Rohner's work being the notable exception.

If a social group is relatively free of a defensive mode, the way is open to an exploring mode, or a more relaxed and integrated calmness that should promote better health and well-being, as is now clear as shown by many studies in behavioral medicine and health psychology (Aldwin and Levenson 2001; Aldwin 2000). Exploring modes lead to greater creativity. Calm modes produce a sense of coherence that helps processes of healing. Winkelman suggests how shamanistic practices bring about autonomic changes where a waking sympathetic dominance is replaced by a parasympathetic dominance involving slower brain waves in the brain stem and hippocampal-septal area of the limbic system. This facilitates the hemispheric synchronization that restores a sense of bodily harmony (Winkelman 2000 p. 76).

The possibilities for an evolutionary framework in social anthropology that can accommodate such questions as the above have increased now that group selection and altruism have been brought back into discussion (Colby and Azevedo unpublished ms; see also Sober 1999; Sober and Wilson 1998; Wilson and Sober 1994). Conflict and cultural variation concerning how an individual relates to different social groupings have evolutionary consequences up and down different somatic and ecological levels (Caporael 1997). More generally, when somatic and cultural capital involve a demographic transition with rising per capita income and education there is an association with a falling birth rate (Vining 1982; Vining 1986). This has been examined with theoretical models of how parental investment decisions lead to lower birth rates (Kaplan and Lancaster 2000). Such studies must allow for cultural differences in class, ethnicity, and other group-wide cultural attributes, as well as varying differences within groups such as gender attitudes (Browner 2000; Mace 2000).

In sum, studies of human fitness -- both a physical sense of fitness; that is, an absolute sense of fitness, as well as Darwinian relative fitness -- are greatly enhanced by accounting for an adaptivity that results in large part from culture transmission. This would require the development of concepts like well-being and cultural success by means of postulates leading to specific measures (for example a quantitative measure of an individual's contribution to the knowledge or ideas circulating within a group; or a study of influence in a social network). Such complexity calls for a systemic approach that embraces biology, social relations, and culture as they all interact.

A Theoretical Program

The Components of a Theoretical Program

Such an approach can be envisioned as a theoretical program, ideally with four components: a discursive context, a core that can be expressed as one or more testable statements, a set of intended applications of the theory, and one or more theoretical models that include theorems, which relate back to the core statement (in the model as an axiom) and its discursive context in a coherent manner through concepts, constructs, and measuring procedures. The theory is a systemic theory if it contains more than a single model in the program and if some of the terms or variables in these models intersect with those of the other models, essentially a network of variables.

Discursive Component

As part of the discursive component, the rationale for the theory of adaptive potential described here acts simply to provide more information on the process that led to the formulation of the theoretical statements and to any revisions or corollaries that may have succeeded the initial formulation. Karl Popper minimized the importance of how a theory is initially developed. For him the crux of the matter lay in presenting that theory in a falsifiable form. Important as that is, it seems that the origination of a theory is also useful. Even if only discursively described, it can have a bearing on two kinds of validity, the validity of the theory-generating process, and the validity of what is being measured, i.e. the relationship between constructs and observations. The discursive component is also relevant to the Kuhnian issue of whether or not a theory is likely to be accepted as interesting and worthy of testing by other scientists.

Core Statement

The core statement of adaptive potential theory goes something like this: To the extent that individual A is higher in the conditions of adaptive potential than individual B, the more fit (physiologically and mentally) individual A is than individual B. So also for individuals as members of some culturally defined group: To the extent that the individuals of a defined group A are collectively higher in the conditions of adaptive potential (described below) than those of a similarly defined group, B, the more fit group A is likely to be than group B.

By fit is meant a proximal condition (the prime example being, current health, both physical and mental) that is predictive of the distal variable of biocultural success. By biological success, however, is not meant a simple count of progeny down the line, but rather some coevolutionary combination of biological with cultural success here referenced loosely by the term, biocultural success, meaning an unspecified (at this level of generality) combination of reproductive success on the biological side and cultural success on the cultural side, both inextricable in their coevolutionary interaction but theoretically distinguishable.

In the pattern/schema tandem theory advocated here, cultural success can be defined in two ways. The first focuses on specific cultural elements or patterns and their proliferation through transmission. Conversely cultural decline would be the decrease in usage of specified cultural elements. The second sense focuses on the success (or lack of success) of an individual who uses particular cultural patterns to some advantage, promoting the longevity and/or well-being of that individual and of fellow individuals associated with those patterns through a social network. The second sense is the one that is modeled and tested here.

Presumably cultural success might conceivably cover any kind of cultural transmission over time, such as the transmission of some specified art, technology, or information at a macro level or the transmission of barely perceptible linguistic changes at the micro level. The combined term, biocultural success addresses the issue of coevolutionary interaction of biology with culture. It is an abstract term that must be specified in a theoretical model through postulates

and transformational statements in some measurable way to form a testable, that is, falsifiable, theorem. That is, in fact, the way the present theory of adaptive potential is stated in a later section (See Figure 1).

Just as natural selection is driven by relative fitness in biological terms, so also for cultural selection which, in a functional view, is driven ultimately by biological motivation however broadly conceived. The core of the theoretical program relates to the overall objective of identifying and measuring cultural well-being and cultural pathology.

Cultural success for an individual would mean success in utilizing culture and in transmitting cultural patterns to others. Cultural success for a particular cultural pattern (like an invention or a procedure) would be measured by the extent to which that invention or procedure was adopted among the members of some defined population. Only in unusual cases involving particular countable items, like the artistic productions of a well-known painter, or in a more mundane area, simply the accumulation of wealth, is such a measurement relatively straight forward. Yet, as is commonly observed, these are very limited kinds of success and do not necessarily lead to physical health and well-being for an individual and his or her family. Monetary or material success is often dissipated down the generations depending on the stewardship of material assets and inheritance. Indeed cultural success in one arena may well be counter balanced by lack of success in others. In a very general and intuitive sense one might say that Mozart, who did not live to a ripe old age, was nevertheless highly successful in terms of cultural transmission through the dissemination of his music. It thus might be argued that a subjective net success on the cultural side was so great as to render Mozart's shorter life span as relatively insignificant. Conversely, one might suggest that anyone living past the age of 100 was likely to be high in biocultural success even though that person may not have gained fame for the cultural patterns he or she might have produced.

The concept of cultural success gets even more complex at the micro level of moment-to-moment linguistic transmission in acts of speech. Further, if culture includes characteristics of transmitted thought, emotional expression, transmitted interpretation, and observed behavior, cultural success might have to be determined in all those respects, indeed in virtually any way that conceivably could be related to those processes.

The term success may have some ethnographic use (i.e. in enumerating informant statements in a study of folk success) but in theoretical terms cultural success, and biocultural success are so abstract that without further specification cannot be used as terms in a testable statement. The concepts of cultural success and biocultural success are thus used as theoretical variables at high and abstract levels of generality.

Intended Applications

The intended applications establish the relevance of the theory through programmatic statements that eventually are realized as theoretical models to be tested. The chief approach of adaptive potential theory is in its prediction of physiological and psychological health. Further applications, however, can be extended to the characterization of interpersonal behavior, ethnic

relations, educational success and national and international politics. Thus the theory is validated or supported through studies of health and well-being among individuals. It is then (in a later section) extended to a much wider arena relevant to the circumstances and situations current in the world today.

Theoretical Models

The theoretical models are quasi-formal (i.e. not as mathematical proofs, but stated operationally to facilitate accurate replication of experiments) statements that tie to a central core statement. The chief purpose of a quasi-formal approach with axioms, postulates, theorems and epistemic statements is to provide a model with sufficient specification to yield falsifiable statements for testing. A second purpose is to establish anchor points for the broader theoretical program in which such statements are contextualized. This might then promote ongoing theoretical elaborations, computer simulations, and exploratory studies. In this manner the chances of rapid theoretical advance and progress in the research program are improved.

With further specification prior to testing a theory a model can develop from an initially qualitative and discursive program description, such as already given in the preceding sections, to a formal organization of the variables being tested. I have followed Jack Gibb's method of formalization as a ready visualization of the relations between axioms and theorems and the various components of those relations (Gibbs 1989). I have departed from Gibbs' method in one particular, which is to reverse his usage of concept and construct to be consistent with the discursive exposition of the theoretical program described here. By concept, I mean something less specific than the referent for construct. This is in keeping, it seems, with the more common usage of the two terms. By construct I refer to a more closely defined component in the theoretical structure than concept. A construct is empirically viable either as a qualitative phenomenon itself, or as a quantitative phenomenon which is linked by transformational statements to measuring procedures and ultimately to the specific values produced by those procedures in tests.

We then proceed by postulates from the concepts in the axiom down to the constructs (see figure 1). From constructs we use transformational statements to link to data referentials at the theorem level. The last level specifies the level of actual testing. Such a specification facilitates a replication of the analytical procedure and statistics applied to the analysis should other investigators wish to test the theory on different samples. If other investigators choose to use different transformational statements, i.e. using different instruments, they would be testing a different theoretical model. Using a diagram thus makes it clear just where two models are replications and where they differ.

Theoretical models in a variety of applications can be elaborated to yield new hypotheses and measures that can add meaning and useful complexity to the program. The models and their measurements commit to a particular testable interpretation of the core theory. While not being formal mathematical proofs, the structure of the testing model should facilitate a more strict formalization. In any case, comparison with alternative or competing theories is least

ambiguous when directed toward explicit theoretical models such as the one described here. Discussions can then center on questions of validity and reliability at the testing level or to concepts, postulates, and constructs in the model.

A General Theory of Evolution

The prime theoretical question in this program has been the following: What are the optimal conditions of material, social, and symbolic life? That is, what are the conditions that make for maximum environmental adjustment and yet maintain a high degree of adaptive potential in the face of environmental change (which in the human environmental situation is constantly in flux)? More specifically, what are the situations— of self, social interaction, and cultural institutions — that maximize human health and survival, social happiness and support, and well-being? This question of adaptive potential is posed in terms of a very general evolutionary theory, one that encompasses both natural selection and cultural selection.

In the conventional view of culture as some total entity or configuration, this general statement of evolution may be hard to conceptualize because examples like kinship systems, or language grammars may appear to be stable in spite of major environmental changes. Of course we know kinship and language systems do change over the long run. But the conventional natural history view of culture does not accommodate those changes. So an evolutionary paradigm seems called for. In working out an initial hypothesis about the conditions of adaptive potential a thought experiment came out of the following three assumptions:

1. Culture is inextricably interactive with biology in a coevolutionary process.
2. Cultural selection and natural selection are theoretically different processes but can be subsumed by a more general evolutionary theory from which a theory of cultural pathology can be derived. In a critique of Toulmin's general evolutionary form of historical explanation (oriented particularly at a conceptual history of science), of which Darwin's natural selection theory is but one illustration, and Holland's adaptive system approach is another (Holland 1992; Holland 1995) Frederick Suppe (Suppe 1977) reduces Toulmin's general theory to key ingredients in natural selection: (a) a "pool" of population entities; (b) a "species" grouping of these entities (c) "mechanisms for altering the proportion of various types of entities in that 'pool' over time;" (d) relative "fitness" for these entities. The more general model I have used would correspond as follows: (a) a "pool" of genes, of cultural patterns, or of individual people; and (b) a "group" of patterns (most likely in an institutional complex) or a group of people (defined by either a single attribute such as shared language, or by an approach such as that suggested by Handwerker (Handwerker 2002)). Then narrowing the application to cultural effects: (c) selective mechanisms of agentic choice or natural selection of individuals as culture-using individuals or groups — the agentic choice involving, as Suppe suggests, two foci: reasons and causes (the first being the personal reasons a pattern is chosen by an individual, the second being the force of collective and institutional influence on that individual's action in making the choice; (d) the utility or functionality of cultural patterns

- in promoting the well-being and survival of individuals and groups. It was something like this more general idea of evolution, encompassing both natural selection and cultural selection, in conjunction with assumption 3 below that a thought experiment was worked out to arrive at the conditions of adaptive potential described in the next section.
3. While evolutionary anthropology extends its purview across many generations in a distal view, there are proximal processes within every individual's life span that influence the end time of that span, which is where the distal process of progeny survival begins. This proximal aspect of evolution can be analyzed in terms of conditions that combine biology and culture in a particular life situation for a particular individual, group of individuals, and the various institutional and environmental circumstances that impact those individuals (relating to the first assumption above). Those individuals who are most successful, and those cultural elements that facilitate success, should be reflective of a generally high adaptive potential, the ability to be successful at any moment through time, but especially under radically changing circumstances, social or natural.⁴

The Conditions of Adaptive Potential

Three Realms of Human Concern

While the mechanisms for achieving biocultural success and longevity are legion, the conditions they work toward to maximize success, conditions of adaptive potential, are hypothesized to be relatively few in number. These conditions are measurable as they relate to three realms of human concern, biophysical (material), interpersonal, and symbolic. Why three realms?

Firstly, there is a convention for it within anthropology that does not depend on a spurious natural history view of culture. Malinowski, for example, described culture as arising out of three lines of human development: (1) "the ability to recognize instrumental objects, the appreciation of their technical efficiency, and their value, that is, their place in the purposive sequence," (2) "the formation of social bonds," and (3) "the appearance of symbolism" (Malinowski 1960: 136).

Secondly this partitioning into three realms is natural to the human brain regardless of culture. The biophysical and interpersonal realms are distinguished as very separate early on by infants. Agency is the salient variable in recognizing the difference. The ability to recognize agency in animate beings comes from a perceptual predisposition first to recognize that some beings behave according to their own internal agendas; second to make an empathic attempt to think about what motivates those agendas, involving what some would call "a theory of mind." Two steps are involved – the distinction between animate and inanimate must extend far down through the animal phyla as suggested in how animals negotiate their environment for food and

⁴ Time specification is left open to allow cross sectional and prospective studies and single points or demarkated spans in time.

safety. But there is a second step that may exist only among mammals or perhaps only a few species among them, notably the great apes, or perhaps only among the hominids. Tomasello would narrow it even further to *Homo sapiens* (Tomasello 1999). This second ability goes beyond the recognition of agency (sometimes described as intentionality) to a recognition of mind that encourages the development of empathic thought. Bruner describes this as a prelinguistic cognitive apparatus or readiness for meaning (Bruner 1990). I suspect that schemas concerning human behavior and the behavior of other agentive beings are neurophysiologically tagged, grouped, and located, or networked, in a way that distinguishes agentive and non-agentive action and facilitates empathic understanding. Indeed there is already neurophysiological evidence for this (Schulkin 2000).

Malinowski's third line of human development, the symbolic realm, is represented by a universal recognition that meaning itself can be a subject of conversation, negotiation, and invention. For anthropologists this third realm requires little justification as an analytical category since it has been such a large part of ethnographic attention and for many represents the very core of culture. Neurophysiologically, there has long been the knowledge of language as taking up a particular area of the brain for receiving language, Wernicke's area, and another for sending, or expressing language, Broca's area. Other areas of the brain are involved as well. The point here is that symbolic behavior is genetically predestined to develop in certain areas of the human brain and is neurophysiologically distinguished from other kinds of activity. In sum, the three realms of human concern is not just an arbitrary categorization, it has an empirical basis.

Given this, we still need to understand why just this tripartite organization is so important to a theory of adaptive potential. The reason is that the conditions of adaptive potential vary according to which of the three realms they apply. Indeed in one case, the motivation for efficacy and control, there are positive health consequences for high control in one of the three categories – the material realm, but negative consequences for high control in another – the interpersonal realm. The distinction between the two is thus of crucial importance.

Optimal Conditions in the Biophysical/material Realm

The conditions for the biophysical (or material) realm were derived in a thought experiment from the very general conceptualization of evolution (assumption 2 above) with focus on its natural selection component and how that is similar in some respects to cultural selection (Colby 1981): In natural selection if a species is efficacious in a niche it will survive as long as the niche is relatively stable. If there is a significant change in the ecology relating to whatever niche the species is adapted to, however, the probability of survival is greater if there is more diversity of phenotype among the members of the species. So also for cultural patterns and social groupings. Different patterns are helpful in dealing with different problems. If there is a change in material or social situation that relates directly to the employment of a particular cultural pattern that pattern may no longer be functional. However if individuals have alternate schemas that can deal with the changed situation, or if they are open to new cultural patterns others may produce, or if they are creative of new patterns themselves, they will have an advantage. So

goes a rephrasing of the very general statement of evolution as it covers both biological and cultural phenomena.

While the drive for human survival originates somatically, meeting them comes primarily through cultural means. Efficacy and diversity of cultural patterns, behaviors, and bodily characteristics are thus the conditions of ecological adaptivity and control in the biophysical (material) realm.

Within this realm human biological imperatives direct one's attention to bodily states and ecological surroundings in the procurement of food, the use of tools, and maintenance of bodily comfort. Efficacy as a component of well-being has been a common subject of investigation in psychology (Bandura, et al. 1988). With increasing cultural complexity innovations in efficacy are learned and passed on from one person to another. How quick or how slow this process is may be a function of adaptive potential which, in turn is affected by institutional inertia and cultural practices, such as puberty and other rituals, that instill traditions and discourage departure from those traditions.

In addition to efficacy in any one activity is the obviously adaptive advantage brought by a diverse repertoire of behavior appropriate to a wide variety of situations. Like efficacy, diversity of pattern-generating repertoire works in favor of both individual and group selection. Assuming that life in a forager band is open to all observers within the band, virtually any pattern can be observed or elicited and learned, though motivation and interest may vary along lines of specialization, gender, age and many other role-linked and dispositional attributes (Boster 1986). Thus, while knowledge and skill repertoire is readily passed on to others through reconstructed schemas, the repertoire is variable in cultural complexity and extent from one individual to the next. This variability will have a bearing on individual success.

Diversity of pattern repertoire in a single individual, within some specified group, or across a population, (depending on the design of the model being tested) is enhanced by openness to noticing and using new cultural patterns. This openness to novelty and exploration is promoted by a parasympathetic state of the autonomic nervous system. Conversely in a sympathetic state a general openness to diversity tends to be inhibited except, perhaps, in dire straits where a focused creativity is forced, giving rise to the folk observation that "necessity is the mother of invention." In sum, the conditions of adaptive potential in the biophysical realm are efficacy and diversity which together provide an ecological adaptivity that can give to the individual (or group) a general sense of material control and adequacy in that realm.

The Interpersonal Realm Conditions

Moving to the interpersonal realm, the optimal conditions of adaptive potential again can be derived from a general theory coevolution, in particular, from processes of group selection that are only now getting the attention they deserve (Sober 1999; Sober and Wilson 1998). In this realm the optimal conditions of adaptive potential are altruism (for reasons partially detailed below) and its componential indicators or necessary preconditions, affiliation and autonomy. Altruism is a condition, ambience, or expectation that is enhanced within any human group by acts of affiliation, affection, assistance, tolerance, and respect for another's autonomy, even (in

stronger degrees of altruism) at some perceived detriment to the individual's own well-being. An individual situated in a social group enjoying high altruism will experience a higher or more frequent sense of harmony and well-being than others not so located. The individual is the recipient of altruistic actions by others and derives satisfaction from helping others as well. Selfish and hostile acts obviously generate retribution and alienate people. Altruistic acts of course help families, but the theory being tested goes beyond kin selection to a wider circle of altruism. Altruism promotes friendship and social support beyond kin groups.

Altruism has biological as well as cultural support, one example being the effects of the neuropeptide, oxytocin, and a subset of the vasopressin receptor (Insel, et al. 1999). These correlate inversely with autism, less time in friendly bodily contact, and low levels of affiliative behavior in general (Carter, et al. 1997; Insel 1992). The higher amount of affiliative behavior and social tranquility among bonobo chimpanzees in contrast to the more aggressive common chimpanzees may relate to genetic differences in neuropeptide oxytocin gene expression in the brain (Schulkin 2000 p. 134).

Earlier I referred to a dark side of altruism as one of two routes to altruism. The first erects mental palings for the group and justifies hostility toward outgroups. In the absence of threats, both within and outside local groups, however, altruism of a second kind is more likely to emerge. This second route leads to a more comprehensive and enduring egalitarian mode than the first, and depends to lesser extent on hostile boundary maintenance. The cross-cultural studies of conflict by the Embers (1992; 1992; 1994) relate less frequent warfare between democratic societies than between authoritarian societies to their democratic institutions for settling internal conflict. The linkage of egalitarianism, authoritarianism and other modalities of interpersonal relations to adaptive potential will be discussed later.

The variables that determine degrees of altruism in any group are numerous. However, the basic components of altruism come down to two: (1) affiliation (particularly expressed positive affect, or the "warmth dimension" as characterized by Rohner (Rohner 1975; Rohner 1986) and as both given and received; and (2) autonomy (both that which is available for the self, and that which respects the autonomy of self in others).

Autonomy is a crucial component because without the sense of self there can be no conscious sacrifice of the self's interest (even in the mildest sense of inconvenience or giving of one's time) in favor of another's (i.e. altruism). Two of Clyde Kluckhohn's binary value categories were similar in some respects to these altruism preconditions: the Self-Other category related to the amount of affection and caring for others and the Individual-Group category related to the degree of individual autonomy commonly experienced in a society (Kluckhohn 1958). Mary Douglas' distinction between Grid and Group can be seen as a further subdivision of Autonomy (Douglas 1978). As insightful as they were, however, these earlier characterizations were ethnographic, that is descriptive) but were not brought into a comprehensive, testable theory, nor were they related to a componential, evolutionary view of altruism or its preconditions.

Some of the better studied variables relating to affiliation, autonomy and altruism are those concerned with socialization effects. For example household size has been correlated with the amount of time an infant was held by the mother (Munroe and Munroe 1971). Many studies show the importance of holding, touching, and other expressions of affection are beneficial (Montagu 1986). The work of Rohner, in particular, (Rohner 1975; Rohner 1986) shows (1) that there is a wide divergence in degree and expression of affection in different societies; and (2) that the low end of affiliation—the (relatively speaking) rejection of children, is associated with several kinds of dysfunction, particularly in the self-concept which, in rejecting societies, is more likely to evoke the defensive scapegoating of external groups. While the divergence in amount and degree of affiliation may reflect underlying allelic predispositions unevenly distributed in different human populations, it is also likely due to social and environmental ecology and to cultural institutions that buffer the amount and degree of stress commonly experienced, (particularly during early childhood socialization) and that institutionalize acts of altruism, commonly through religion. Clearly there is a relationship between these findings and similar observations in ethology (Eibl-Eibesfeldt 1989) and some of the epigenetic rules proposed by Lumsden and Wilson (Lumsden and Wilson 1981). Though in the latter case, this recognition goes without subscribing to the concept of culturgen, a precursor to Dawkins' meme. Culturgen is a polythetic set that lumps mentifacts with artifacts and hence fails the tandem requirement (distinguishing cultural schemas in the mind from cultural patterns observed in the environment to facilitate theorizing about culture transmission and change).

Recognizing and allowing the autonomy of another person who has needs separate from those of the self is a prerequisite for altruistic behavior. That is, if in a highly paternalistic or authoritarian society others are treated merely as adjuncts of the self, as extensions of the self, or under control of the self, then favors done for that other person are in essence favors done for the self. Thus the recognition of autonomy in another person is a necessary part of altruism.

As to autonomy, to recognize autonomy in another person – the pro-social or tolerance aspect of autonomy, it is first necessary to have a sense of autonomy and agency for oneself. When both self-autonomy and prosocial autonomy are present in a society there is a tolerance of variation in personality and behavior that increases the diversity of cultural patterns for coevolutionary selection.⁵

In a preinstitutional time, supposedly, the selection of dispositional altruists in contradistinction to institutional (e.g. in today's world what might be called politically correct) altruism among foragers conceivably would have been a stronger process by itself than it is in

⁵ It is interesting to note here that Edward Wilson, in his *Sociobiology, the New Synthesis*, remarks on the decline in cohesiveness, altruism, and cooperativeness among the social animals as one moves up through the phyla. Wilson sees this as a paradox (Wilson, Edward O., 1975 *Sociobiology: The new synthesis*. Cambridge: Harvard University Press.) but it is a paradox only through a failure to appreciate a componential or preconditional understanding of altruism. As one moves up from the colonial invertebrates and the higher social insects to humans there is an increase in the autonomy component of altruism. This autonomy is enhanced by consciousness, the recognition of agency in individuals, and a more elaborated self-concept.

today's more extensively institutionalized societies where altruism is both a prescribed value and an experientially arising disposition of phenotypically varying degree. Boehm's argument for forager egalitarianism may relate to this (Boehm 1999). To be sure, there may indeed be more instances of altruistic acts in a society where such acts are supported through institutions. The presence of institutions was an important requirement in Ruth Benedict's theory of cultural synergy (Benedict, et al. 1970). Since many altruistic acts presumably reflect public pressure and institutional effects as opposed to some psychological predisposition towards affiliation and altruism they may not always reflect the strength of underlying dispositions for autonomy that Boehm sees as motivating forager egalitarianism (Boehm 1999). In addition, somewhere between underlying dispositions and institutional supports for altruism is the direct interactional experience people have that theorists model with games like the prisoner's dilemma (Gintis 1999; Harsanyi and Selten 1988; Orr 1999; Samuelson 1997). So in the absence of institutional sanctions that favor altruism, as presumably were absent in the case among the earliest forager groups, altruism had to be more dependent upon direct interactional experience and underlying dispositions with their genetic, as well as epigenetic components (i.e. the effect of post-conceptual experience, or of the environment, on the developing phenotype). It is in the area of experientially based cellular memory where new variations conceivably might be transmitted to descendants (a formerly heretical thought that is once again coming under scrutiny) that some of the most interesting developments in coevolution might be found (Jablonka, et al. 1992).

Optimal Conditions in the Symbolic Realm

Finally, we come to the third realm in the theory of adaptive potential being proposed here. For want of a more completely descriptive term, I refer to this as the symbolic realm. In this realm the optimal overall condition of adaptive potential I first hypothesized was creativity for the production of new, and modification of existing, cultural patterns. In early tests of the link between adaptive potential and physical health creativity was defined as a combination of high imagination and metaknowledge (testing ideas, inventions and theories; knowing how to know and learning how to learn (Colby 1981; 1987b)). This was later expanded to include other elements of creativity such as the building of coherence in created products and their fit with practical or aesthetic needs. It also relates to general meaningfulness as derived from goal schemas. It might also extend to reflexive thinking or metamentation (Bogdan 2000) on a higher, more general level. Most recently after some exploratory studies I would focus on goal orchestration, including goal deferment (as described in a later section).

This latter function would be in accord with new work by Deacon, Damasio and others concerning the forebrain (Damasio 1994; Damasio 1999; Deacon 1997) where there is an emphasis on the importance of planning, looking out for the best interests of the self and others, including disciplined goal deferral, as a major function of the prefrontal cortex. In general, the symbolic process mediates between imagination and a fitting of symbolic thought (e.g. language) to situations in the real world where it is important to have good reality control (as opposed to denial, projection and other defense mechanisms that distort reality in the service of a weak ego)

but at the same time to have the imaginative ability to think into the future which requires distancing the self from the reality of the immediate moment.

Meta-knowledge in the modern world includes truth-testing, which is a major activity of science and philosophy. Measuring the propensity to seek the truth, to understand the mysteries of the universe and simply to recognize reality in day to day living (as opposed to denial and other forms of ego defense that distort those aspects of reality) may not be readily done. Nor is the other component of creativity, imagination, without measurement problems as attested to in the difficulty in measuring creativity in personality theory. The expression of imagination and divergent thinking, as the raw material of creative production, is enormously varied in type and expression. Since the creativity condition is the most problematic of the three overall conditions of adaptive potential, much of the exploratory analysis following tests of the theory is directed at this third condition and its components.

The Security and Freedom Dimensions of Adaptive Potential

The three conditions, as measured by their component parts, add up to a general measure of adaptive potential (see Table 1 below).

Three of the components, one in each of the three realms, -- efficacy, affiliation, and metaknowledge -- promote feelings of security and general well-being. These conditions are supportive of cultural norms that result in high adaptive potential. The other three components - - openness to diversity, respect for the autonomy of others, and fostering creative imagination, or ideaphoria -- promote the use and proliferation of divergent schemas and patterns, and the "freedom" to abstract elements or characteristics from a larger whole or from their usual context, making for more abstract thought elements. In the interpersonal realm, this would also be a kind of political freedom through the autonomy condition. When all three of these freedom components are high there is a general sense of release from restraint, particularly from overly rigid adherence to cultural norms. This aspect of adaptive potential would be most advantageous during times of changing circumstances when cultural norms might more likely be perceived as maladaptive. When both the three freedom and the three security conditions are positive, individuals and groups are more likely to experience overall well-being and good health. general sense of release from restraint, particularly from overly rigid adherence to cultural norms. This aspect of adaptive potential would be most advantageous during times of changing circumstances when cultural norms might more likely be perceived as maladaptive. When both the three freedom and the three security conditions are positive, individuals and groups are more likely to experience overall well-being and good health.

Table 1 *Showing conditions of adaptive potential in three realms of human concern*

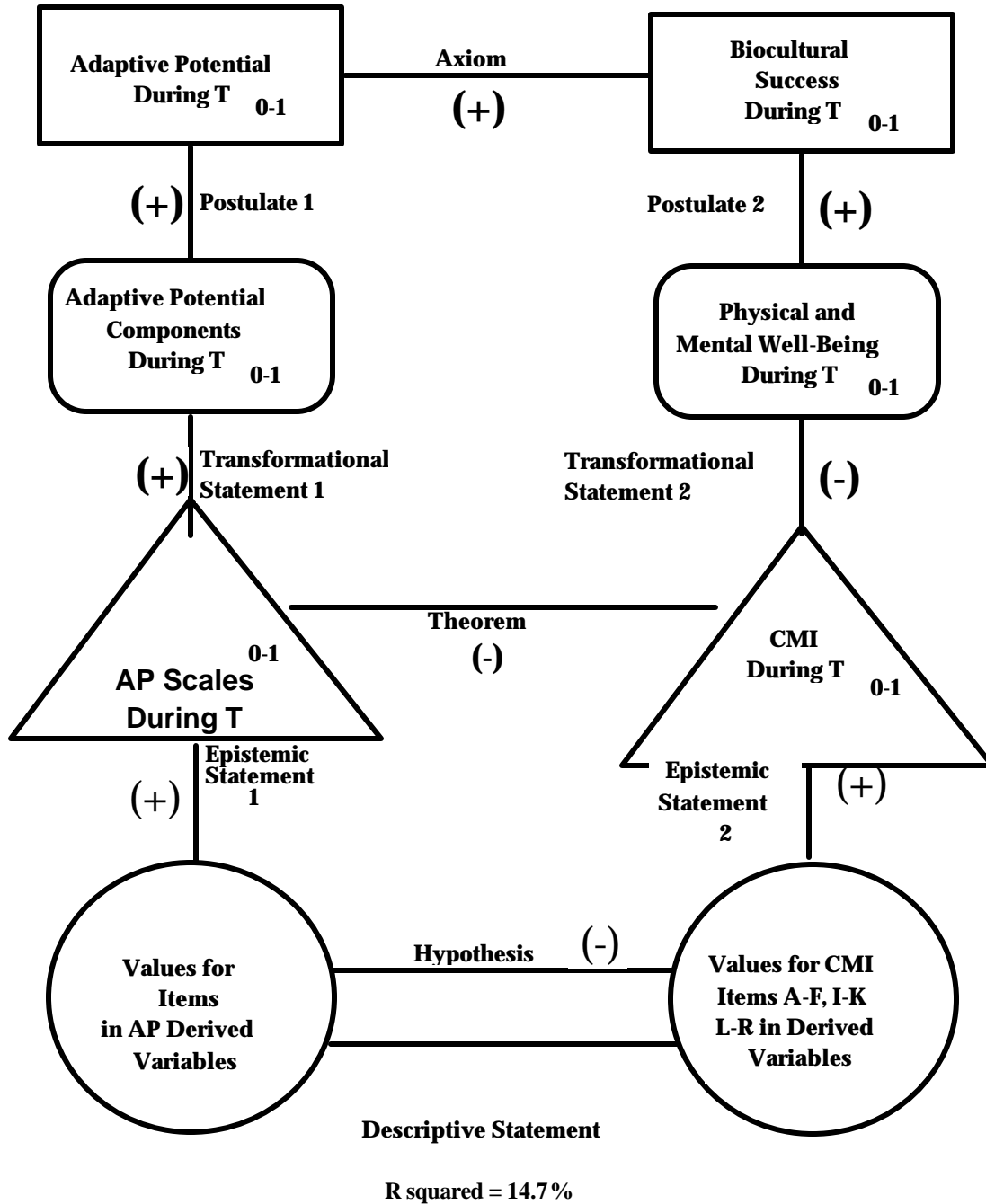
Realms of Human Concern	Overall Conditions	Security Conditions	Freedom Conditions
Biophysical (material) Realm	Ecological Adaptivity and control	Efficacy	Diversity
Interpersonal Realm	Altruism	Affiliation	Autonomy
Symbolic Realm	Creativity	Meta-knowledge (Knowing how to know – science)	Imagination (Divergent Cognition)

The Biological Substrate of Adaptive Potential

The theory of adaptive potential assumes that these conditions of the three realms arise from deep level physiological needs. This assumption is based on the following line of reasoning:

1. The body needs to keep cortisol, catecholamines and other stress related hormones at some optimal level that varies in response to different environmental situations.
2. Optimal hormonal balance, being a responsive need (i.e., geared to respond to external events, most notably stressors) must undergo regulatory shaping from experience – probably starting with intrauterine experience including maternal stress and continuing after birth as the individual grows into adulthood.
3. As bodily needs tie into the experiences of each individual, regulatory processes of the autonomic nervous system orchestrate with memories of those experiences.
4. Given the universal elements of human phenotypes and the universal aspects of the human condition at the deepest levels there has been, since the early hominids, a selection for individuals and groupings that maximize ecological adaptivity over the material realm (through efficacy and diversity), altruism in the interpersonal realm (through affiliative warmth and pro-social autonomy) and creativity in the symbolic realm (through imagination, coherence, and metaknowledge).
5. Finally, an effective orchestration of goals relating to these needs is greatly facilitated through culture which plays a crucial role in mitigating, dampening, or transducing stress, and in diminishing confrontations with stressors.

Figure 1: A testing model used in a recent study of adaptive potential and the predictor variables in the Cornell Medical Index. (following Gibbs' formal mode of theoretical statement [Gibbs, 1989 #3749])



A Theoretical Model

So far three theoretical models have been employed in developing the adaptive potential program. The first model tested biocultural success in terms of culture transmission

(Colby 1981). The second (Colby 1987b; Colby, et al. 1985; Milanesi, et al. 1994; Mishra, et al. 1991) and third (Colby and Azevedo unpublished ms; Colby, et al. unpublished ms) models have focused on well-being and physical health. These have been measured by the Cornell Medical Index (Brodman, et al. 1955), negative affect (Bradburn 1969), and the Belloc and Breslow measure of physical health (Belloc and Breslow 1972) Variations of the second and third models have used either different symbolic realm components or different measures of health. The third model described here is diagrammed in figure 1, above.

The general concept of adaptive potential is specified with Postulate 1 in terms of the three conditions, adaptivity, altruism, and creativity and their respective components. These are linked by transformational statement 1 to the measuring instrument, a questionnaire with a 7-point scale anchored by strongly disagree at the low end and strongly agree at the high end, with gradations toward a neutral or 0 point in the middle.

The predicted (dependent) variable is organized under the concept of biocultural success. The particular model, shown in figure one is cross-sectional so all the time delimiters are the same. Biocultural success is then predicted by physical and mental well-being at the time of the test, a linkage expressed by postulate 2. From there transformational statement 2 links it to a specific measure of physical and mental health, the Cornell Medical Index (Brodman, et al. 1955). Since this index is a list of symptoms which the respondent checks either yes or no to, the relation of the Cornell Medical Index to the construct physical and mental health is an inverse one indicated by the negative sign next to the connecting line. The hypothesis itself is an inverse relationship as well.

The axiom at the top reads, "Among the individuals of a group, the greater the adaptive potential during T_{0-1} the greater the biocultural success at T_{0-1} " It is tested by the theorem further down in the figure which says that among individuals the higher the score on the adaptive potential scales (AP) during T_{0-1} , the fewer the number of symptoms (CMI) at T_{0-1} .

The actual test on a sample of individuals is represented by the values for each individual for each test item. The descriptive statement for the test itself includes the test result in terms of a correlational measure and its associated probability figure.

The Test

In the example described here the sample is defined by the sharing of the same institutional pattern complex experienced by students at the University of California, Irvine. In the data collected other cultural pattern information such as ethnicity (defined by birthplace and history of

language exposure by the respondent and the respondent's parents) have been included to facilitate exploration after the testing phase of the data analysis.

The primary measures are the Cornell Medical Index (CMI) and the Adaptive Potential Scales (AP). The CMI includes both physical and psychological sections (omitting the gender specific items and a few other items inappropriate for the student sample). The A through K sections concern purely physical bodily symptoms, the L through R sections are psychological symptoms. The main test of the model was between adaptive potential (AP_{tot}) as measured by its combined components in a single variable and CMI_{Tot} (total of the CMI section scores). That test supported the theory with an adjusted R squared of 31.5% (T ratio = -10.5 prob = <0.0001)⁶ Given the current findings in health psychology and behavioral medicine one would expect a higher correlation of AP with the psychological sections of the CMI than with the physiological sections. Indeed that is the case with an R squared of 39% (t-ratio = -12.3 , prob = <0.0001). Correlation with the physical symptoms alone (sections A through K) are also significant, though with a lower R squared at 14.7% (t-ratio = -6.48 prob = <0.0001). These correlations, however, are for the measures of adaptive potential in the biophysical and interpersonal realms, not the symbolic realm which, in this particular study involved a different set of conditions than the creativity conditions previously tested.

Exploration

Following this test, the adaptive potential variable was disaggregated into its components and brought into a step-wise multiple regression test shown below, Table 2.

The exploratory variables in this test were measures of coherence and meaningfulness, particularly with respect to the orchestration of goals, which seemed especially suitable for the symbolic realm. They also appeared to be necessary in the creative process. So the analysis of these components in a multiple regression would be of interest. What was found was that in the presence of the four defining components for the adaptivity and altruism conditions, coherence and meaningfulness do not add significantly to the explained variance. They were chosen to test in this study because Antonovsky's similar measure, "sense of coherence" had been related to better health outcomes in the past (Antonovsky 1988). In addition earlier work had suggested the importance of coherence-building processes in another connection (Colby 1989a; Colby 1987a; Colby 1991). Since these variables did not explain anything beyond the conditions for the first two realms more work was clearly indicated for the symbolic realm conditions of adaptive potential. The thought experiment had done well enough for the first two realms. Now it seemed time to approach the evolutionary quest from a different angle, away from abstract evolutionary thought experiments toward skeletal findings of early hominids and new understandings of neuropsychology. Recall the previously mentioned findings in

⁶ I am indebted to Kathryn Azevedo and Maria Rodriguez, who collected the data. Aside from the main test illustrated in figure 1 the results reported here focus on the exploratory phase of the study. A more complete study will be reported in a joint paper (Colby, Azevedo and Rodriguez, forthcoming).

neuropsychology which highlight the prefrontal cortex as the most rapidly developing anatomical structure in hominid evolution (Damasio 1994; Damasio 1999; Deacon 1997; Fuster 1989).

Dependent variable is: **CMITot**
 No Selector
 253 total cases of which 15 are missing
 R squared = 32.6% R squared (adjusted) = 31.5%
 s = 11.35 with 238 - 5 = 233 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	14539.4	4	3634.84	28.2
Residual	30024.5	233	128.860	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	28.2193	1.149	24.6	≤ 0.0001
Efficacy	-0.338211	0.1655	-2.04	0.0422
Affiliation	-0.422863	0.1216	-3.48	0.0006
Diversity	-1.10493	0.3818	-2.89	0.0042
Autonomy	-0.440330	0.1813	-2.43	0.0159

Table 2 Stepwise multiple regression of four adaptive potential variables on the total score for the Cornell Medical Index (CMITot)

One thing that stands out with respect to neural processes in the prefrontal cortex is the ability to look after one's own best interests extending well beyond the immediate context of situation. The widely cited case of Phineas Gage, survivor of an explosion that removed part of his prefrontal cortex, is a dramatic illustration of this ability and its lack (Damasio 1994). More considered responses to immediate situations are presumably guided to some extent by local beliefs and values concerning socially approved behavior and locally defined success. These are abilities that Phineas Gage had before, but not after, his accident. The prime element here is the ability to defer immediate gratification in favor of longer-term goals. This timing element in goal pursuit clearly relates both to proximate well-being and to long-term biocultural success and thus merits consideration as a condition of adaptive potential.

One of the value orientation pairs developed by Kluckhohn (Kluckhohn 1958) came close to this process. His Discipline-Fulfillment was defined in terms of Benedict's relativistic Apollonian-Dionysian, or safety-adventure, contrast, rather than as a contrast between self-discipline and immediate hedonistic fulfillment. This is no small difference. The hedonistic-self discipline contrast is closer to an adaptive potential type of measure where one side of the

contrast might have selective advantage over the other rather than a binary category that was as balanced as possible reflecting the relativistic bias of the received culture theory.

A review of other scales used in our study found six items relevant to self-discipline and the deferral of immediate gratification, all from a scale we have not yet reported, the Defense Style Questionnaire (Bond 1991). These were then selected as items for a new exploratory adaptive potential condition. In a stepwise regression four of these six goal control components were significant predictors of high CMI scores, yielding an adjusted R squared of 27% and F-ratio of 23.4. T ratios for the four ran from $4.90 < 0.0001$ to $2.37 < 0.0187$. From this result a new candidate variable was derived that combined these four and entered as Goal Control with the other AP variables in a stepwise regression.

In this new exploration, diversity dropped out as a variable contributing significantly to the variance while goal control became the strongest of all the variables. Since the analysis was ex post facto the R squared of 41% and F-ratio of 43 must be regarded with enormous caution. The association is striking however, and strong enough to pursue discursively. If a satisfactory line of discursive reasoning explains the association (beginning with the above basis that led to first trying it out), the next step would be to develop a modified theoretical model with a series of new items concerning goal control and deferral of immediate gratification, for testing with a new sample. This would be a significant advance in the program since the symbolic realm was the one with the weakest correlations in earlier studies.

A further exploration of the diversity variable (in the biophysical realm) found that openness to diversity was a stronger, perhaps more easily measurable concept than some attempt to inventory a major part of the skill repertoire in terms of variation in cultural schema. Indeed in an unchanging material environment diversity might even be a disadvantage. The key element of evolutionary process is change. It is only with major natural and social changes that diversity in gene pool and in cultural patterning can be advantageous, provided some elements of the gene and cultural pools turn out to have adaptive advantage. Here is where culture has such a powerful role, because ideally all one needs is one or a few individuals to come up with some useful adaptive response for all other members of a culture-using community to copy—provided, of course, that those other members are open to innovation. The diversity variable in future tests of the theory, then, should focus more on the openness quality, rather than simply the existence of numerous alternatives for doing something.

Having run the test and the after-test explorations, where does the overall program stand? The core of the program, the overall axiom in which adaptive potential predicts well-being in terms of physical and mental health (and by implication, biocultural success) is supported in the overall variables, Aptot (minus measures for the symbolic realm) and CMI_{tot}. Of the three optimal conditions and their components postulated in the original thought experiment there has been more support for the biophysical and interpersonal realms than for the symbolic realm which has remained problematic (though difficulty of measurement may be just as problematic as the conceptualization). The timing element in goal orchestration and its possible relation to diversity now emerges as the prime area for further study and measurement.

Realms of Human Concern	Overall Condition	Security Component	Freedom Component
Biophysical (material)	Control& Adaptivity	Efficacy	Diversity
Interpersonal	Altruism	Affiliation	(Prosocial) Autonomy
Symbolic (1)	Creativity	Metaknowledge	Ideaphoria
Symbolic (2)	Coherence	{Social Justice}	Meaningfulness
Symbolic (3)	Noesis/Logos	{Stewardship and Ritual}	{Self-Discipline}

Table 3: *Showing the three realms and the conditions of adaptive potential associated with them. The three alternatives for the symbolic realm demonstrate the provisional nature of those conditions. The first resulted from a thought experiment and was tested. The second and third are based on ideas concerning the pre-frontal cortex and its significantly more recent development in Homo sapiens. These are still being explored and organized for future testing.*

In this way exploration in alternation with tests can modify the theoretical models and overall program through successive approximations toward mechanisms of culture transmission and predictors of biocultural success that are still largely unknown (at least in the context of the present theory). In such a manner it is possible to move toward discovery processes that concern more dynamic and systemically interlinked cultural processes.

The current mode of the program described here has focused initially on the more rapid procedure of questionnaire administration. With improvements in the questionnaire studies other types of analysis become increasingly desirable as corroboration of the overall theory. In particular, the use of content analysis may yield better results in some respects. For example, the recent finding that content analysis predicts longevity and protection from Alzheimer's disease among Catholic nuns (Danner, et al. 2001; Snowdon, et al. 1999; Snowdon, et al. 2000) would fit right into a research program of adaptive potential. Reliability of such studies could be enhanced by computer facilitated content analysis (Colby 1985).

Wider Implications: The Modalities Of Interpersonal Relations

The validation of affiliation and autonomy as adaptive potential variables makes possible a next step in the program, that of defining modalities of interpersonal relations. While for some purposes modalities may require more nuanced conceptualizations of agency as for example in work by Browner (2000 p. 784) it is useful to single out 4 basic types as shown in figure 2 below. These modalities sum up interpersonal relations as observed through commands, suggestions, questions, interactive discussions and responses in the behavioral patterns of interacting individuals and groups. Motivating these observed expressions are underlying

attitudes that go beyond face-to-face behavior to political attitudes, voting behavior, and ideologies, both political and religious. Each modality thus helps to explain commonly observed psychopolitical behavior and ethnic attitudes as they characterize the general social surround of an individual. The four modalities are illustrated in figure 2 below.

		Affiliation	
		Low	High
Autonomy	High	Competitive Relations	Egalitarian Relations
	Low	Authoritarian Relations	Paternalistic Relations

***Figure 2** Showing four modalities of interpersonal behavior as defined by components of the altruism condition of adaptive potential.*

Paternalistic Relations

As implied by their defining constituents, paternalism characterizes an affectionate but unequal status as between father and child where the child has low autonomy. This modality extends beyond the family to other individuals, and groups in which a dominant person or group regards another person or group as needing special care, requiring guidance, being child-like, or variously lacking in cultural capital or wisdom and hence lacking the ability to be an autonomous individual.

Competitive Relations

The competitive modality emphasizes autonomy but lacks positive feelings of affiliation and hence paternalistic responsibility. In the absence of affection autonomy loses its prosocial character. It focuses inward on the self and can turn hostile toward outsiders seen to constitute a competitive threat.

Egalitarian Relations

Respect, tolerance and affection characterize the egalitarian modality. They also greatly increase the frequency of altruistic acts. Presumably it is the modality most conducive to a positive (parasympathetic) autonomic state.

Authoritarian Relations

Authoritarian modalities emphasize control through patterns of dominance and submission (Altemeyer 1981; Altemeyer 1996). This modality is more likely to be expressed when there is a perceived threat or stress levels are high. For example, Sales found a correlation between economic stress and increased authoritarianism in United States history (Sales 1972; Sales 1973; 1973). Authoritarianism is relevant to human evolutionary studies because it emphasizes a defensive and hostile boundary maintenance motivated at least in part through past or chronic high levels of autonomic arousal. The authoritarian modality characterizes the social hierarchies that are so visible among chimpanzees, baboons, and other animals and which strongly influence the production of corticosteroids and presumably other stress substances (Sapolsky 1992).

Discussion

The above application of the theory is limited to the interpersonal realm conditions of well-being: autonomy and affiliation. A related extension of the above categorization adds conditions in the other two realms to define the general tone or mood of behavior as a kind of expansive freedom and a feeling of security with a group or family as already illustrated (see Table 1).

While totalitarian societies emphasize a rhetoric of security along with institutions that promote security of a kind, security is undermined through intolerance of the autonomy of citizens. Further, in practice there tends to be a low level of affiliation which negates that security and which reflects conditions mapped in cross-cultural studies (Rohner 1975; Rohner 1986).

This discursive discussion suggests a general direction that future applications of the theory might go. Three modalities, paternalistic, competitive, and egalitarian, were discussed at length (prior to the development of adaptive potential theory and the componential definitions of the modalities) in the analysis of ethnic relations in Chiapas Mexico and in Guatemala (Colby 1966; Colby and Berghe 1969; van den Berghe and Colby 1961). Redefinition of these modalities in terms of adaptive potential theory suggests how biological substrates might motivate behavior and channel it symbolically and ideologically through institutional forces that function for these substrates as suggested by Malinowski's need/institutional functions.

Summary and Conclusion

In summary, with a definition of culture in terms of pattern/schema tandems, the analysis of culture transmission becomes more tractable. Since culture buffers stress and increases fitness the mechanisms and content of culture transmission can be related to adaptive potential and tested. Optimal conditions of adaptive potential differ by realm: adaptivity for the biophysical realm, altruism for the interpersonal realm, and more provisionally, creativity (and possibly goal orchestration) for the symbolic realm. These conditions predict well-being and health. In successful tests of the conditions, the conditions themselves become validated as theoretical constructs. A pattern/schema tandem concept of culture facilitates a theoretical program such as the one just described. Because it covers both phenomenal and ideational orders it

accommodates cognitive as well as macro-level social anthropological studies and might also extend to studies in linguistic anthropology, biological anthropology, and archeology.

To conclude, it has been argued here that social anthropology has not been irreversibly converted to an exclusively humanistic endeavor at the expense of science. We can emerge from the recent science – anti-science turmoil with a clearer vision of the relevant issues and with renewed vigor for anthropology as a scientific enterprise. Moreover, the movement back to science does not preclude a more informed concern for values and the study of sociocultural pathology as I have tried to show. Clearly theoretical programs such as the one I have just described raise many issues not touched upon here. My focus has been on how theoretical programs in social anthropology can move forward even in areas of study thought to be outside the purview of a scientific approach. A progressive program alternates between tests and exploratory studies in successive approximations to some objective reality. The use of theoretical models and discourse makes the process more transparent. The relationship of this approach to issues usually regarded as part of the humanities may help to once again bring the four fields of anthropology – linguistic anthropology, biological anthropology, sociocultural anthropology and archeology together in a humanistically concerned, yet vigorously scientific discipline.

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ⁱ I thank the National Institute on Aging for a their grant (1 R21 AG06987-01) to study adaptive potential variables and their correlates.