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Culture and Cognition: the Role of Cognitive Anthropology in Anthropology and the Cognitive Sciences

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I. Introduction

Human beings are thinking, talking organisms. Consequently, it seems obvious that cultural anthropology and, specifically, cognitive anthropology would be a central player in studies on the relationship between cognition and culture. Surprisingly, this is not the case. Cultural anthropology largely operates at a qualitative level without, it seems, feeling the need to understand or examine individual cognition. In turn, cognitive psychology has placed an enormous bet that it can understand the human mind without taking into account social processes within which the human mind operates. While theories and quantitative methods of cognitive Psychology are elaborated, studies in Psychology focus almost exclusively on undergraduates at major research universities performing certain tasks in 50 minutes or less on a computer. Given these major differences it should not come as a surprise that cognitive anthropology – far from being a central player - is something of an orphan within the cognitive sciences.

On a more optimistic note, in the cognitive sciences there has been an increase in focus on the role of both language and culture in cognition. This upsurge ranges from a powerful revival of studies on the Sapir-Whorf hypothesis — that language affects thought (e.g. Gentner and Goldin-Meadow, 2003) — and to the idea that culture not only affects what people think but how people think (e.g. Nisbett, 2003). Cognitive anthropologists have taken tentative steps to reconnect with the other cognitive sciences and with evolutionary models of culture and cultural change. They also show signs of questioning the Lone Ranger model of cultural research and supplementing or replacing it with the idea that research collaborations drawing on a diversity of skills, perspectives, and orientations may be more effective.

However, even this limited optimism must be tempered with caution. What has come to be called "cultural psychology"[1] has broadened the cultural base for psychological studies but continues with a heavy focus on college students at elite universities. Just that now some of the student participants are selected by their non-European ethnic background (with an often ill-conceived idea of ethnic background often treated interchangeably with cultural background or worse yet race) or with comparative studies being conducted at universities outside the US. Cognitive anthropologists, on the other hand, by ignoring laboratory studies of cognition in principle, find that, in practice, their knowledge of theories and data is outdated. In brief we are short of the conditions that would foster the sort of mutual respect and interest that would make cognitive anthropology a key player in both anthropology and in the cognitive sciences.

We hope that this chapter will help bridge the gap and for that purpose we proceed as follows: First, we elaborate a bit on the history of cognitive science and its relation to cognitive anthropology in order to provide one perspective on the relation between cognition and cognitive anthropology. Next, we argue that this perspective is outdated and ineffective. Then we turn to the relation between cognitive anthropology and other approaches to the study of culture and cultural processes. This will lead us to our central thesis —- that cognitive anthropology must be central both to studies of culture and to studies of cognition. To do so, however, it must stretch and bind itself to its neighbors. With these arguments as background, we describe some facets of our ongoing research that illustrate these themes.

Cognitive psychology grew out of behaviorism and has always emphasized tight experimental control of variables and other forms of methodological rigor. By the time the Cognitive Science Society was founded in the late 1970's, however, cognitive psychologists were at home studying meaningful materials such as text. Under the influence of cognitive scientists such as Robert Abelson and Roger Schank (e.g., Schank & Abelson, 1977), theoretical constructs like schemas and scripts came into use.

This richer set of theoretical tools and perspectives was broadly attractive to cognitive scientists. Philosophers of language, linguists, AI researchers, and cognitive anthropologists each seemed to have something to offer. Perhaps buoyed by these developments, in one of the early issues of the society's new journal, cognitive science, cognitive anthropologist Roy D'Andrade (1981, p. 182) suggested that there might be a convenient division of labor between psychology and anthropology: psychologists

would study how people think and anthropologists would study what people think, using the conceptual tools growing out of cognitive science research.

We believe that process/content difference was meant to be a division of labor under the common overarching goal of understanding the human mind in its social context. In practice, however, it became a rationale for mutual ignorance between cognitive anthropology and the rest of cognitive science. In addition more recent developments in the cognitive sciences indicate that what people think is inseparably linked to how people think and vice versa.

First, let's look at cognitive psychology at its worst. We do not think it is an exaggeration to say that cognitive psychology suffers from rigor mortis. For each novelty in research materials or procedures a cottage industry tends to develop. Phenomena are studied in such minute detail that there is the ever present danger that they are learning about properties of the paradigm rather than properties of the mind. Researchers quickly hone in on materials that produce effects of interest, but, as a consequence, it is difficult to assess the robustness and generality of the phenomena in question (Medin, Bennis and Chandler, under review). Add to this the convenience sample of undergraduates taking introduction to psychology and there's not much to excite cognitive anthropologists.

Cognitive anthropologists (and presumably other people as well) conceptualize people as social beings, adapting to real world environments where history and context are central. Cognitive anthropologists obtain their data by collecting data in real world contexts, not by sitting participants down in front of a computer and keeping social interaction to a minimum.

Round one goes to cognitive anthropology, if you're willing to tolerate the sort of stereotyping we've adopted. But by the same rules cultural anthropology doesn't fare so well in round two. Historically speaking, cultural anthropology has waivered between two untenable positions. One is the view that "participant observation" allows access to the "omniscient informant" leading to claims like "the people of culture x believe y" without any apparent need to report actual data. The second and contrasting view comes from what is often considered as one offshoot of postmodern criticism on anthropological research. Contributors to this line of thought argue that hopes of understanding another culture are illusory. In its extreme form this critique suggests that the observer and the observed are so intertwined that one cannot tell which is which, irretrievably undermining much of what social science strives for. In this scenario, the best anthropology could hope for is for researchers to describe experience and encounters with other people. We agree that the problem of the observer has

to be taken seriously, yet disagree with the impossibility of conducting comparative research.

A further complication is that it's not always clear what the proper unit of analysis should be in cultural anthropology. Most researchers who study cognition, and presumably nearly all cognitive psychologists, locate cognition in individual minds. But some anthropologists treat culture as a "super-organism" with emergent (cognitive) properties (see Atran, et al, 2005 for a review) and researchers who take a "situated cognition" perspective locate cognition to activities in particular contexts and explicitly deny that cognition is a property of individuals (e.g., Hutchins, 1995; Lave, 1988). Even if this difference in perspective is just a matter of definitions, it is an impediment to bridging between cognitive anthropology and the rest of cognition.

In summary, from the perspective of cognitive psychology, cultural anthropology involved exotic people, unclear methods, very little actual data and little to no involvement in cognitive science debates. From the perspective of cultural anthropology, in general and cognitive anthropology in particular, the data from cognitive psychology are so artificial as to be useless and largely irrelevant to any of their concerns. As a consequence these two disciplines have had very little to do with each other.

To make matters worse, we see cognitive anthropology as having distanced itself from debates in cultural anthropology. We identify with cognitive anthropologists' worries about explicit and formal field methods, but, at times these worries have come at the expense of an involvement with important questions of wider anthropological theory. Hence cognitive anthropology may have lost relevance for the wider field of anthropology. We do not pretend to have provided an overview of the history of cognitive anthropology and we plead guilty to trafficking in stereotypes. But we don't think we are far off in our conclusion that cognitive anthropology has been widely isolated from both of its parent disciplines: cultural anthropology and the cognitive sciences. This isolation comes at a time when cognitive anthropology may be instrumental for significant advances in both disciplines. It is to this possibility that we will now turn our attention.

Cognitive anthropologists view the rising interest in cross-cultural studies in the cognitive sciences as a mixed blessing. The idea that a cognitive psychologist can call up a colleague in Tokyo, persuade him or her to run some task with Tokyo undergraduates, and thereby become a cultural researcher just may not sit well. Aiming to understand culture in terms of values on two dimensions (e.g. eastern collectivism versus Western individualism) may be useful for some purposes, but it is not the sort of take

on culture that anthropologists live and labor for. Another more conceptual criticism is that most of these studies treat language and/or culture as independent variables; we will return to this point.

There has also been a recent upsurge of interest in modeling cultures as dynamic systems using evolutionary models(for an account of social cooperation in general and altruism in particular see Hamilton, 1964, Trivers, 1971, see also Axelrod, 1997). More recently this focus has been broadened to include attempts to understand the epidemiology of ideas (Blackmore, 1999; for alternative frameworks see Sperber, 2000; Richerson and Boyd, 2004, Aunger, 2000).

However, usually such evolutionary models of culture and cultural have not been (well-) informed by research in either cognitive anthropology or cognitive science more broadly. For example, the main mechanism for cultural transmission in these models is imitation and although theories assume that successful and powerful others are more likely to be imitated (e.g. Henrich and Gil-White, 2001), there are deep conceptual issues associated with the very notion of imitation that have tended to be ignored (see Henrich and Henrich, 2007) for a notable exception). Also, imitation is only one of a set of possible learning and reasoning mechanisms (Atran et al, 2005). For example, children do not acquire adult beliefs simply by being exposed to them (Quinn,1997; Hirschfeld, 2002). To a large extent cultural anthropologists have not weighed in on these issues, despite the fact that their research seems highly relevant to them.

The preceding material is one view of the current state of the art. The gist of things is that there are grounds for optimism with respect to the relation between cognitive anthropology and cognition on the one hand and anthropology proper on the other. But translating this opportunity into meaningful engagement and inter-disciplinary collaboration and cooperation remains a serious challenge. In the remainder of this chapter we describe ongoing research and theory aimed at demonstrating the critical role that cognitive anthropology has to play.

Specifically, we offer four main suggestions. First, an understanding of how the mind works (cognition) is needed to better understand the mechanics of cultural processes, arguably the goal of anthropological research. Second, an understanding of social processes and the specific environment (social and physical) within which the mind develops and operates is essential to better understand cognition, arguably the goal of the cognitive sciences. As both cognitive and social factors are heavily interconnected, they must be explored in conjunction with one another. Cognitive anthropology is ideally positioned, in principle, to follow this lead

and add substantial knowledge to both the cognitive sciences and cultural anthropology. Third, given that cognitive anthropology is not currently pursuing this goal we offer suggestions with respect to theory and methods to do so. Fourth we'll argue that "culture" should be studied as the *outcome of social and cognitive processes*, an emerging product rather than a set of rules, grammars to be detected, or worse yet, as an independent variable.

II. Overview on Human Cognition

Much of the development of the human brain takes place outside the mothers' womb within close contact with the immediate social and physical environment. This experience with the environment provides important input for brain development, including the development and change in neural connections (Linden 2007). On the other hand, infant learning is guided by a series of innate and quickly acquired skeletal principles that are specific to particular domains such as language, (naïve) physics, (naïve) biology, (naïve) psychology and number (e.g. Carey and Spelke, 1996; Baillargeon, 2004; Bloom, 2002). It is between these two interacting poles that cognitive anthropology needs to locate its research, incorporating and providing a theoretical understanding that accounts for both aspects: innate principles and malleability of neural structures. As a result, cultural knowledge is not simply copied from one brain to the next, nor is it irrelevant for the developing mind.

This perspective suggests a balance of attention between "universal or at least bounded cognitive mechanisms" and an embedded cognition where cognitive and social factors interact. Before proceeding, we first sketch a definition of culture that we consider useful in our attempts of understanding the interaction of culture and cognition.

Culture: the outcome of cognitive and social factors. In our view, culture comprises both mental and public representations such as material productions, speech and other aspects of behavior in particular ecological contexts (see Sperber 1996; Ross 2004). What we refer to as culture or cultural concepts are those representations that are relatively stable and systematically distributed within a population (Atran, et al, 2005; Ross 2004). Much of our view concurs with ideas often summarized as "distributed cognition" (Cole 1996; Vygotsky, 1978; Hutchins, 1995). We see cultural processes as the outcome of the complex interaction of individual cognitive processes interacting with each other and with their social environment. In the next few paragraphs we describe four implications of this orientation towards culture.

First, in order to conduct meaningful cross-cultural research we aim to

avoid cross-cultural studies where "culture" is treated as an *independent variable*. Treating culture as an independent variable is inherently circular unless the notion is unpacked into a series of dimensions or values that could in principle be manipulated. In this case, however, the concept of culture becomes empty and can be discarded. Simply naming differences "cultural" does not add anything to our understanding of either "culture" or "cultural processes" or their interaction with cognition.

Second, adopting this perspective forces us to perceive cognitive processes as *situated or embodied manifestations*; i.e., as mental activities relevant to an individual's life, which take place within a specific social and physical context. Consequently, it reinforces a research strategy of examining cognition in relevant contexts.

Third, this view of culture enables us to better illuminate the interaction of cognitive and social processes. When we talk about cultural change, we are talking about conceptual change (within and across individuals) as well as about changes in the distribution of specific concepts within populations. To the extent that the formation and transmission of concepts depends on the flux of information, it is important to widen our analysis of *information* to any kind of information input or cultural practice, and not focus solely on explicit propositional content. "Culture" and "cultural differences" cease to be the endpoints or even the focal points of our research. Instead, we focus on the distribution of representations within and between populations with the goal of explaining patterns of agreement and disagreement. Both cultural processes as well as the resulting distribution of agreement patterns form part of a dynamic system we describe as culture. In this approach it is as important to explain both *cultural stability/resiliency* as well as *cultural change* as the outcome of complex processes (Ross et al. n.d.).

Fourth and finally, viewing culture as a distribution of ideas and practices avoids essentializing culture or defining it only in terms of consensus or agreement. Instead of treating disagreement as failure to form or maintain a consensus, it becomes central to our distributional approach (it is signal, not noise). In our account both agreement and disagreement need to be explained as structures emerging from the interplay of social and cognitive factors.

We will revisit our definition of culture toward the end of this chapter. For now we turn to some research findings that illustrate the main points of our argument. Much of our data will come from the domain of folkbiology. This is not only our own area of research, but it also allows comparison across cultures (everyone knows at least something about plants and

animals). Furthermore, it is a domain with which human beings have had contact from the earliest time of human history.

III. Categories, Reasoning and Expertise

Below we discuss four questions that direct ways we can think about "cultural and experiential differences" in categorization, conceptual organization and the use of categories in reasoning.

1. Do experts and non-experts agree on concepts and categories? This was a question Linda Garro tackled in her study of curers and non-curers in Pichataro, Mexico. Using a question-answer frame technique Garro was able to show that both groups agreed on a common model of disease (and health) with curers agreeing more with one another than non-curers. This higher agreement implies *more knowledge* with respect to the culturally appropriate beliefs (Garro 1986; 2000).

Ross et al. extended this research by revisiting the study after 30 years and by including the bio-medical personnel that arrived in the community shortly after the initial study conducted by Garro. Much to our surprise and despite a plethora of changes that occurred in the community, we found that experts and non-experts still agree with one another (and with the models from 30 years ago), but disagree systematically with biomedical staff working in the community clinic and pharmacies (Ross et al. n.d.). This study showed not only the persistence of cultural knowledge, but also agreement across levels (but not kind) of expertise.

2. Does expertise affect category-organization? Boster and Johnson (1989) conducted interesting research with respect to the effects of different levels of expertise in categorization. Specifically, they examined knowledge and sorting pattern (categorization) among expert fishermen and novices (college students). These researchers noted that while morphological information about fish (provided on stimulus cards in the form of pictures) should be available to novices and experts alike, access to more specific information related to functional and utilitarian aspects requires expertise. (See Chi & Koeske 1983; Gobbo and Chi, 1986, Johnson and Mervis, 1998 for converging evidence from cognitive developmental research).

Boster and Johnson found that novices relied more on morphology when sorting fish than did experts whereas experts relied more on functional information based on commercial fishing goals. The authors argue that shifts associated with the development of expertise do not resemble a change from an incoherent to a more coherent model, but instead represent a change from a readily available default model to a newly acquired model, based on different goals and information. (See Medin et al, 1997 for data with tree

experts showing that different types of expertise lead to different categorization schemes.)

These data are interesting on two accounts. First, they pose the existence of a default system of categorization (at least for the domain of folkbiology) and second they point toward the acquisition of expertise as a process of modifying conceptual structures to attune to different kinds of information and goals. Point one echoes findings by Boster et al. (1986) and Boster (1987) supporting claims made by Berlin (1992) about the existence of a natural default categorization scheme. Point two, on the other hand, clearly indicates differences in conceptual knowledge that emerge with increasing expertise.

Barsalou's argument of goal-driven categorization (1991) (different goals lead to different categorization schemes) presents at least in part a good basis for understanding these types of results. Changes in categorization schemes based on new information can also be observed in the history of sciences. For example, Dupre (1999) has shown that historically the categorization of whales shifted, not in response to more knowledge about whales, but rather because of changing concepts of what it means to be a fish.

3. Does culture affect categorization? There are clear effects of culture on sorting behaviors (e.g. Lopez, et al, 1997). These cultural differences remain even when overall expertise is controlled for. Medin et al, 2002, 2006, examined the sorting of local freshwater fish among both experts and non-experts of two adjacent populations in Wisconsin: Menominee Native-American and European-Americans. European-American fishermen tended to organize categories in terms of goals and in terms of taxonomic relationship with more expert fishermen being more likely to employ taxonomic relationships. Menominee fishermen also used these strategies but, in addition, showed a strong tendency to sort in terms of ecological relationships (e.g. habitat); this strategy was as equally relied on by both Menominee experts and non-experts. Ross et al, 2003 report similar differences for children, initiating an exploration into the emergence of cultural models.

together these studies underline the importance of using converging methodologies to study folkbiology. In the initial sorting participants were asked to pile sort 44 local fish (written on cards) into groups based on similarity (see Borgatti, de Munck, and Handerwerker, this volume). Individual fish-fish distance matrices were created and compared across participants. Resulting patterns of agreement and disagreement were

explored across lines of expertise and culture.

Using the cultural consensus model (Romney et al. 1986) we established that both group shared an overall agreement. We aggregated the data for each group into a combined model, which was analyzed using multidimensional scaling. In order to represent the model of the European-American experts two dimensions were needed, correlating with desirability and size. For the Menominee data three dimensions were needed to achieve a fit for their sorting data. Two dimensions correlated with size and desirability and the third dimension – not found among European-Americans – correlated with what we termed an ecological dimension (for example sorting by habitat).

This task was followed, months later, by several different but related tasks. First, we asked participants to describe fish-fish interactions for all possible pairs of 21 fish species (e.g. “Does the largemouth bass affect the river shiner or the river shiner affect the largemouth bass?”). As before we found cross-group consensus, but Menominee experts held a clear sub-model not shared by Euro-American experts. Menominee experts reported more relations overall and more reciprocal relations. We also noted that Euro-American fishermen mainly reported interactions involving adult fish of the kind "a musky will eat a northern". Menominee reported these relations too, but also added relations between fish during the whole life cycle (e.g. “a musky will eat a northern and northern fry hatch…”) as well as non food-chain relations (destroying the nesting place of X). In contrast, the small set of relations reported by Euro-Americans appear to be over-generalizations. They typically involved food chain relations between predator and prey fish that are rarely found in the same waters. Had the studies stopped here it would seem natural to conclude that we were observing cultural difference in knowledge and we might have been able to weave a story about why Euro-American fishermen mainly learn about adult fish. Readers in Anthropology might have liked our conclusion with respect to the intricate knowledge of indigenous people. However, here is where ethnography and spending plenty of time with fishermen outside of a formal interviewing situation came into play. What made our results puzzling was that we had heard more than one Euro-American expert mention that northern hatch out on the spring a few weeks before muskies do. It also seemed implausible that Euro-American fish experts would have so little ecological knowledge.

In order to test this idea we followed up with a second experiment exploring the knowledge individuals hold about fish habitats. In this task participants sorted the fish according to different habitats. Two findings are

important here. First, members of both groups did NOT differ in their responses and second, Euro-American experts correctly described fish as not sharing a habitat, for which in the previous task they had described a *big eats small* relationship. These data reinforced the notion that the encountered differences did not represent a simple cultural difference with respect to ecological knowledge.

Instead of representing differences in knowledge per se, perhaps the cultural differences encountered were more about *knowledge organization* and related *accessibility*? The sorting task suggests that Menominee fishermen make use of an ecological organization, which might facilitate answering questions about fish-fish interactions. On the other hand, if the Euro-American experts focus more on taxonomic relations it may take more time and effort to retrieve information about ecological relations. To test this idea, several months later, we repeated the fish-fish interaction task but this time reduced the number of probes from 441 to 35, while still allowing an hour for the task. If our analysis was correct we should have found that: 1. the cultural differences would disappear, 2. Euro-American experts should start to answer in terms of the full life cycle of fish and 3. Menominee experts would be relatively less affected by the pace of the task. All three predictions received strong support.

We take these data to indicate two things. First, experts of the two groups share a good amount of base knowledge with respect to ecological relations and fish habitats. This should not be surprising given the fact that on average experts of the two groups have fished for over 40 years. Arguably, knowing where fish can be found represents an important piece of information. Second, this ecological knowledge is not equally accessible. We find systematic group differences (that one might be tempted to call cultural), yet these differences are not in knowledge per se but in access to this knowledge.

These findings have important implications for our theories of culture and cognition. For starters they illustrate the importance of a combination of formal quantitative tasks and ethnographic methods. With respect to the formal approach, our findings show that it is important to pay attention to the nature of the interview and the probes applied. Instead of attempting to find some “gold standard” task that will reveal what people think or know, it is only by coordinated and converging measures across a range of tasks that one begins to understand cultural differences.

Many of the studies we reviewed have been dealing with categorization in relation to expertise and culture..Two questions emerge immediately. Are the categories elicited in our research meaningful? Or

asked differently, do the elicited categories more or less reflect the knowledge organization of our participants? The second question is, ”If categories are affected by culture and expertise, do we find the same influence with respect to reasoning strategies? “

4. Does expertise and culture affect reasoning? Clearly if categorization provides the building blocks of thought (reasoning) and if categorization is influenced by expertise and culture, reasoning necessarily differs along these lines as well. However, the more interesting question at this point would be whether the use of categories in reasoning differs across expertise and culture.

Reasoning strategies can be described as heuristics for inference making (or decision making) when relevant information is incomplete. In these situations humans make use of heuristics or strategies to fill in the blanks and make inferences. We will focus on two kinds of reasoning. The first is inductive reasoning about categories and their properties (what is often called category-based induction or CBI), especially in the biological domain. Cultural research has shown the importance of framework theories and the organization of knowledge to this kind of reasoning. The second, related form of reasoning is causal reasoning, where interesting cross-cultural research is also being done (Burnett and Medin, 2008).

Research on the use of categories in reasoning has been guided by theories of induction that suggest principles of induction that may be universal. Probably the best known theory is the Osherson, et al (1990) similarity-coverage model. Three phenomena associated with the theory have received the most attention *similarity*, *typicality* and *diversity*.

The s*imilarity* principle of induction describes the fact that two kinds seen as similar (closer related in terms of their taxonomic distance) are more likely to share a previously unknown (and invisible) property / characteristic, than two kinds that are taxonomically more distant. For example, informants usually judge mice and rats as more likely to share some unknown property than mice and penguins.

The *typicality* principle describes the fact that more typical members of a category are more likely to have features common to all the category members than less typical ones. For example, if informants are told that sparrows have some protein x inside them and that penguins have some protein y inside them, they judge that it is more likely that all birds have protein x rather than protein y.

Finally, the *diversity* principle describes the fact that individuals are usually more likely to ascribe a property to the whole category when told that two taxonomically different category members share that property, than

when told that two taxonomically similar category members share a property. A projection from mice and cows to all mammals is stronger than a projection from mice and rats to all mammals.

These three phenomena are very robust when tested with undergraduate populations in the USA. However, cross-cultural and cross-expertise studies reveal quite a different picture. Lopez et al. (1997), for example, compared the categorization and category-based induction of University of Michigan students with Itza' Maya of the tropical rainforest of Guatemala with respect to local mammals (for each group a slightly different set of mammals was used). They found that Itza' Maya and Michigan undergraduates tended to sort mammals in more or less similar ways, yet only the Itza' included ecological factors in their considerations. Both groups showed similarity and typicality effects in reasoning. However, although undergraduates relied heavily on the diversity principles, Itza' Maya farmers showed *below chance* diversity reasoning.

While the study has obvious limitations (for one it confounds cultural differences with differences in age, education etc. and most notably expertise), results do challenge, however, the universality of at least one of the reasoning principles, *diversity*. Furthermore, Lopez et al noted that the Itza' Maya understood the principle of sampling diversity in selecting seeds for crops. The challenge then is to understand why the two groups reasoned so differently when it came to taxonomic diversity.

Subsequent studies pinpoint domain knowledge and expertise as being the critical factor (see for example Proffitt, Coley, and Medin, 2000; Bailenson, Shum, Atran, Medin, & Coley, 2002; Shafto and Coley, 2003; Shafto, Coley, and Baldwin, 2005) and it appears that ecological and causal reasoning can override category based reasoning when sufficient knowledge (deemed relevant) is available.

Summary. Let's recap our findings with respect to expertise and culture on categorization and reasoning. In general both experts and novices seem to make use of category structure in their reasoning strategies. Reasoning strategies often are linked to *causal understandings*. Experts, however, having more and different kinds of knowledge available, are more flexible in their causal reasoning. Causal stories, however, are not uni-dimensional, but are often influenced by the foregrounding / backgrounding of specific kinds of information. One way to envision this is Barsalou's argument of goal-derived categorization (1991), special ways of categorizing and reasoning that make certain kinds of knowledge more or less accessible. On this account then, cultural differences may often be saliency effects driven by framework theories or epistemological orientations that lead to

different orientations with respect to some domain such as folkbiology or the relation of human being to the rest of nature (Bang, et al, 2007).

IV. Implications for conceptions of cultural change, and cultural learning.

Anthropological lore has it that knowledge is passed down from elders (experts) to younger generations (novices) and therefore culture is carried through time and space. But we need to examine whether and how this is actually accomplished. The idea that the passing down is no more complicated than handing down an heirloom substantially underestimates the complexity of cultural transmission and begs off on one of the central questions in cultural anthropology and cognitive science. First, it assumes an unproblematic, faithful reproduction of models and knowledge through time (stability of culture), where change is seen as rupture that needs to be explained. Second, it assumes that all knowledge is somehow *passed on*, relegating learning to the passive act of receiving information. Third, it fails to account for the fact that faithful transmission / copying of information is almost impossible (Sperber 1996). Fourth, and perhaps most important for the anthropological context, it ignores the fact that much (if not most) of cultural knowledge is not explicit. In this section we take up questions about what is transmitted in cultural transmission, how it might be transmitted and whether it leads to cultural stability.

Stability and instability. Earlier we briefly mentioned the study conducted by Ross and collaborators in Pichataro (Mexico). The heart of the research consisted of a restudy of work conducted by Linda Garro in the same community some 30 years ago (1986; 2000). Exploring whether curers and non-curers (all females) shared a common folkmedical belief system, Garro found that, overall, members of the two groups agreed with respect to their folkmedical understandings, with the experts having the highest level agreement with one another.

Soon after this initial research a medical clinic was established in Pichataro, introducing not only free biomedical services, but also health education provided by the clinic staff. In addition, a large flow of transnational migration to the USA lead not only to influx of money, but also knowledge. Finally, improved infrastructure (roads; bus and taxi services, but also phone and internet services) opened Pichataro up to information not only from the nearby town of Patzcuaro, but through phone and internet-services to the world at large. In short, one might expect significant changes in folkmedical models over the last 30 years.

To test this and specifically to explore the role of the biomedical staff

as potential agents of change, we conducted a restudy in 2007, using the same question-answer frame applied by Garro. We matched our participants as closely as possible with the individuals interviewed by Garro (age, expertise etc.). Rather than asking whether the same individuals changed their models over the last 30 years, we asked whether the knowledge available to adult women in the community has substantially changed over the last 30 years – both with respect to curers and non-curers.

Introducing bio-medical experts allowed us to link potential changes to the emergence of the clinic in the community. Several findings are important for our current purposes. First, 30 years after the initial study curers and non-curers still share a common folkmedical model. Second, the model held by curers and non-curers is significantly different from the model elicited from the biomedical staff. Third, curers and non-curers agree with one another as much as they agree with the general folkmedical model held in Pichataro some 30 years ago[1] (Ross et al. n.d.).

Taking into account that we did not interview the same participants as Garro did 30 years ago these findings are striking. The folkmedical model learned by a new generation of curers and non-curer adult women in Pichataro has not significantly changed over the last 30 years. The presence of a medical clinic did apparently not affect the acquisition / production of folkmedical models in the generation following the one studied by Garro. We say *production of folkmedical models* as these models are not talked about much and as a result each individual needs to generate a good part of the answers rather than copying the model wholesale from an expert. It is important to note that from its inception into the present the clinic was and is well attended by community members, making it even more surprising that the respective models of the biomedical staff seem not to have affected the folkmedical models entertained in the community.

While these data are encouraging with respect to the maintenance of cultural knowledge, data from other parts of the world are less positive. Previously, we documented striking cultural differences between Itza' Maya and Ladino farmers in mental models of the forest, the nature of the forest spirits and in sustainability of agro-forestry practices (Atran, et al, 2002; Atran, et al, 2005). Since that time substantial changes have come to this part of Guatemala, including a blacktop road linking Flores to Guatemala City, the development of ecotourism and Spanish language schools as well as continuing Ladino immigration. LeGuen et al have recently assessed the

[1] Unfortunately we were not granted access to the original data and hence could not make direct comparison across time and expertise.

inter-generational stability of mental models of the forest and conceptions of forest spirits. Both Itza' and Ladinos show substantial loss of ecological knowledge and a shift in value orientation towards economic concerns. Although we had earlier reported that Ladino farmers showed deference to Itza' Maya farmers and sought out their expertise, there is no evidence of inter-generational change in the direction of the Maya model. Instead, LeGuen et al found that the Itza' notion of the forest guardians, the Arux, had become assimilated towards the Ladino understanding of the Duende.

These two case studies raise a central problem for cognitive and cultural anthropology. Why in the first case is there little change over three decades despite the introduction of western medicine but in the second case there is dramatic change over a single generation? In the latter case we are also challenged to explain why the change has taken the particular form that it has. One can always speculate *after the fact* but the need for post hoc theorizing underlines just how incomplete our theories of cultural learning are.

How then should we envision cultural learning? First a disclaimer is in place. Much more research is needed to better understand the processes, channels and units by which knowledge / models are transmitted. It is safe to assume that while some copying goes on, there is no guarantee for faithful copying, nor is it possible that copying is the main process of learning. If copying is not the main process, however, the question becomes what kind of processes would produce the results described above? In other words, how – in the absence of copying – is cultural stability or cultural change achieved across time and individuals?

We think that one productive line of research lies in the area of reasoning strategies. Category-based and causal reasoning strategies allow individual learners to use an existing framework to make their own inferences, e.g. generate knowledge on their own by filling in the blanks when needed. In this account framework theories in the form of categorization schemes and abstract relational expectations might provide the groundwork upon which individuals reflect when in need of an answer (for example, when asked by the occasional anthropologist).

Two kinds of frameworks are plausible and have been argued for in the literature. *Innate biases* as well as *cultural frameworks,* like the one described for the Menominee above. *Innate biases* are domain specific biases. For example, Waxman et al (2006) found that Menominee, as well as rural and urban European-American children, ascribe an essence to species of living kinds. In this view, species are what they are because of their essence. On top of this general framework (see also Astuti, Solomon and

Carey 2004) Menominee children – drawing on salient discourse about ethnic / racial identity in terms of blood quantum – may tend to identify blood as a carrier of essence.

Using the often used "adoption paradigm" we asked children whether an animal adopted at birth by an animal from another species (pig & cows) would grow up to be a member of the species of the birth parents or of the adoptive parents. In a series of tasks several conditions were described (such as “always snuggling up with the adoption mother”, "eating the same food as adoption mother", "drinking the milk of the adoptive mother" etc.). Only in the case of a total blood transfusion (the target animal was described as being sick and in need of a compete blood exchange) with the blood from the adoptive mother were some Menominee children willing to change their predictions concerning the kindhood of the adopted animal when grown up.

Even the cryptic description of the task makes it clear that these results are based on questions an individual will probably never be confronted with outside the research context. Does this make the questions useless? We do not think so. First, most cultural knowledge is implicit. Second, responses to our questions are fairly systematic across individuals, indicating that children used similar strategies and extracted similar background information when producing new knowledge (answers to our questions). The result is agreement on a topic about which they probably never had thought about before, using publicly available and shared knowledge (the role of blood quantum for tribal membership).

We also noted earlier that both Menominee hunters and fishermen and Menominee children show greater attention to ecological relations than their rural Euro-American counter-parts. How does this ecological orientation get passed on? Of course, one possibility is explicit teaching, but that is only one. Bang et al, 2007, asked Menominee and Euro-American children and adults about the nature and frequency of their outdoor practices. They found that Euro-Americans were much more likely to engage in practices in which nature is back-grounded (e.g. playing baseball) and much less likely to engage in practices in which natures is fore-grounded (e.g. berry-picking). There is independent evidence that what we might call “psychological distance” affects cognitive processing in a variety of ways, including inferences and attributions (see Trope and Liberman, 2003, 2009).

A related set of observations come from Unsworth (2008). She asked Euro-American and Menominee adults to describe the last encounter they had had with a deer. In addition to the content of the stories she also recorded the gestures used. The two groups did not differ in the overall likelihood of using gesture, but they showed a very large effect of

perspective when gesturing about deer. European-American adults would "place" the deer in some location (using their hands) but a significant proportion of Menominee adults "became" the deer in gesture. That is they were reliably more likely to take the deer's perspective in gesture than were Euro-American adults. We are currently conducting studies to examine whether this difference in gesturing affects children's learning, reasoning and discourse concerning nature.

This leads us to one final study we would like to mention. We just argued that perspective-taking is related to the differences of how Menominee and Euro-American hunters see the world. In a sense, "becoming the deer" takes into account the surrounding world from a perspective other than direct, human egocentric interaction with the environment. Rather than being the center of the universe, where nature becomes a backdrop for hunting and fishing, Menominee seem to explore nature at least in part through multiple lenses and perspectives.

We have evidence for similar multi-perspective taking from Tzotzil-Maya of Chiapas, Mexico, and how it might influence spatial encoding. The specific studies were designed to test the relation of language and spatial cognition- one of the last holdouts of the linguistic relativity theory, the idea that language determines the way humans think. For spatial cognition the argument has been made most strongly by Steve Levinson and his research group (Levinson et al. 2002; Brown & Levinson, 1992; Levinson, 2001; Levinson, 2003). Previous studies compared English and Dutch speakers (languages that do encode relative spatial references such as right and left) with speakers of languages that usually do not encode spatial relations in relative terms (different Maya languages for example). Initial findings suggested that speakers of languages that do not encode right and left indeed encode spatial arrangement in different ways (maintaining, for example absolute directions, such as North and South). Different tasks to test this idea have been employed, all related to a "recall under rotation" paradigm. In this paradigm the participant observes a spatial arrangement on a stimuli table, which she is then asked to reconstruct on the recall table, after it is rotated 180 degrees. English speakers usually arrange the items on the recall table by maintaining the right - left order while necessarily violating absolute directions (North-South). However, Maya speakers do the opposite—arranging items according to an absolute system of spatial references that violate the relative frame of reference. Important criticisms of the research methods have appeared but do not provide an alternative account of the data (Li and Gleitman 2002)

Using the rotation paradigm we conducted studies with Tzotzil Maya

as well as Spanish speakers living in a community in the Highlands of Chiapas, Mexico (Ross et al. n.d/b.). While Maya speakers performed the task as expected, Spanish speakers also seemed to employ an absolute orientation, despite the fact that Spanish makes heavy use of relative spatial references. This indicates that language cannot be the driving force for people's performance in this task. What then could account for the data? We had several trials where the stimuli materials FACE participants rather than being lined up in front of them from left to right. Interestingly, many participants arranged the items on the recall table FACING AWAY from EGO while also maintaining the absolute direction of the arrangements. This suggests that the participant's might not have used an absolute system of spatial encoding, as suggested by the original researchers, but instead combined *perspective taking* with a relative frame of reference – from the viewpoint of the items rather than EGO. Ethnographic interviews support this idea. Several participants explained that their parents had always told them about the importance of taking into account what other elements – such as animals – might think or feel, rather than only thinking about themselves. In this explanation, the participants take themselves out of the scenario, rather than seeing themselves as the center of attention. If this explanation is correct, it does not come as a surprise that what has been described as the use of an absolute reference frames has only been reported for small-scale indigenous groups, with a focus on older culturally more expert participants. In this account then, the relative frame of reference with EGO at the center of attention might well be the product of western / urban thought rather than being driven by language. We need more data to make a final call on this issue. However, at this point we can clearly reject the idea of language driving the spatial encoding.

From an anthropological perspective these data are important as they undermine the notion of language as an independent variable and instead put epistemological framework theories (Ross et al. 2007) at the center of potential explanations.

V. Culture: the precipitate of cognition and communication

From our discussion of reasoning strategies it should be clear that category structure is only one anchor for human reasoning and that category structures themselves need to be explored in terms of their specific properties (such as the differences between fish categorization between Menominee and Euro-American fish experts). Other anchors for human reasoning are provided by more specific information, such as causal theories, general habits, biases etc., such as the worldview of "everything has a role to play" that we ascribed to Menominee Native-Americans.

We further argued that knowledge organization influenced the accessibility of certain types of knowledge. The differences in accessibility of types of knowledge on the other hand affect the kind of knowledge that is generated and as a result becomes salient within a population.

Where and what is culture in this account? "Culture" is an elusive concept that can not serve as an explanatory tool to understand specific processes of human behavior, as the very same human behavior is part of that very same culture informing further processes of inference making etc. As a result, "culture" becomes an emergent property of agreement patterns within and across populations. In this sense studying culture becomes converted into the exploration of the emergence of patterns of agreement and disagreement (including with respect to behavior), linking them to specific constellations of cognitive and social factors. Looking at culture and cultural processes from this perspective, it is clear that individual cognitive processes explored by the cognitive sciences and the larger scale cultural processes studied by anthropologists are inseparable.

Despite their serious limitations, experimental studies conducted in the psychological laboratory can be useful in providing methodologies and theoretical tools for further field research. But lab studies continue to suffer from the lack of attention paid to the social and physical environment within which cognitive processes are produced, transmitted, acquired and shaped. To attend to these issues will require trading in some of the control provided by the laboratory and artificial stimuli and using in-depth studies conducted in the real world combining ethnographic work with experimental research.

Cognitive anthropology can provide the ideal bridge between the two fields of which it forms a subdiscipline. It deals with just the kind of populations cognitive science needs in order to make arguments about cognitive mechanisms and could provide the ethnographic insights needed to understand our experimental data. It can contribute concise field-experiments, providing at the same time the necessary ethnographic context to design, run and interpret such studies. In sum, cognitive anthropology has the potential to provide the conceptual bridge for an interdisciplinary focus on the following central question: How does human cognition and social life interact to create human culture? Clearly this question is of equal importance to both the cognitive sciences and cultural anthropology, bringing us back to the point we made previously. Cognitive anthropology should claim a central role in both fields, bridging two related yet separate disciplines. However, as for any bridge, in order to do so the field of cognitive anthropology needs to be firmly grounded in theories and methods of both disciplines. The ground charted in this chapter might provide some starting

points to follow.

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[1] Many readers will be familiar with the term, cultural psychology, and associated it with one of its advocates, Rick Shweder (1995?). Our sense is that the term has been co-opted by social psychologists doing cultural research and that its meaning has shifted substantially.