Influence of Culture and Language on Concepts and Cognitive Functions

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Abstract

Whether and to what extent concepts and basic cognitive functions are universal is of fundamental importance for understanding of the nature of human thought. On the one hand, a shared cognitive architecture might be argued to provide constraints on the nature of knowledge and thought processes that transcend cultural differences. On the other hand, much of human knowledge is acquired through the medium of language and in the context of specific cultural needs and interpretations, and thus language and culture may filter or shape the knowledge acquired and perhaps even the cognitive processes that typically operate on them. In this panel, we present three papers that examine these possibilities from different angles to deepen our understanding of the interplay among universally shared conceptual/cognitive constraints, culture, and language.

Key words: anthropology, categories, cognitive development, concepts, cross-cultural cognition,

Overview

Waxman and Medin focus on the relation among core knowledge, naming, and acquisition of the folk biologic concept 'ALIVE'. Adopting a cross-linguistic, cross-cultural, developmental perspective, they ask a) what capacities young children bring to the task of acquisition, and b) how the environment shapes the process of acquisition. Categorization, naming, and reasoning tasks given to preschool and primary school children from Indonesia, Mexico, and the U.S. revealed important commonalities in early development and also illustrate an intimate connection among culture, language and conceptual organization in the evolution of knowledge. Waxman and Medin emphasize the advantages of combining psychological, linguistic, and anthropologic methods in developing theories of acquisition.

Ross also highlights cultural aspects in the development of children's understanding of folkbiology. He argues that, first, in order to understand cognitive universals we need to enlarge our data base beyond the standard populations (white urban middle class children in industrialized countries), and second, in order to understand children's development we have to better understand the context of knowledge acquisition. Ross uses data from Tzotzil Maya children in Mexico to outline a study of child development that is sensitive to the socio-cultural context in which the children grow up. In this approach culture is not an independent variable, but has a distributional character. The focus of the analysis is not on comparisons of means across different independent variables, but on tracing patterns of agreement and disagreement as a function of wider social processes and the resulting background of the individual children. Ross' approach brings together anthropology and psychology with respect to topics and theories as well as methodologies.

Imai and Saalbach examine the influence of language, culture, and universal cognitive constraints on everyday object concepts. They tested whether numeral classifiers as a grammatical categorization system have any impact on the conceptual structure of speakers of classifier languages. They also ask whether East Asian rely on different conceptual relations than Westerners do when grouping objects, as suggested by Nisbett and colleagues. For the purpose of disentangling linguistic, cultural, and universal cognitive constraints, Imai and Saalbach tested children and adults speaking Chinese, a classifier language, and those speaking German, a non-classifier language, on a range of tasks including categorization, similarity judgment, label extension, and inductive reasoning. The results suggest strong cross-cultural similarities in global conceptual structure and, at the same time, some effect of the classifier system. On the basis of the data, Imai and Saalbach discuss how language-specific linguistic properties might affect concepts, categories, and cognitive processes, and how they interact with task-specific constraints as well as universal cognitive dispositions.

Malt will discuss the preceding three presentations, drawing from them lessons on how research on the relations among language, culture, and thought may begin to be more fruitful.

Core knowledge, Naming and the Acquisition of the Fundamental (Folk)biologic Concept 'Alive'

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Abstract

I begin by describing (in broad strokes) a collaborative research venture in which my colleagues and I have focused on the acquisition of folkbiologic knowledge. We adopt a cross-linguistic, cross-cultural view to ask a) what capacities young children bring to the task of acquisition and b) how the environment (including the objects and events that populate that child's world, the language used to describe them, and the cultural practices invoked to highlight them) shapes the process of acquisition. The work presented here focuses in children's construal of the concept 'alive' or 'living thing'.[1] After describing briefly the populations we have included thus far and our research strategy for identifying the contributions of language and culture in the acquisition of the concept 'alive', I offer evidence from 4- to 10-year-old children from the US, Indonesia, and Mexico. This work reveals important commonalities in early development and also illustrates an intimate connection between culture, language and conceptual organization in the evolution of knowledge. I close with a discussion of the advantages of combining psychological, linguistic and anthropologic methods. in developing theories.

Introduction

Acquisition of Folkbiological Knowledge

A considerable amount of research has been devoted to the acquisition of 'folkbiologic' knowledge, or people's everyday, intuitive knowledge about the biological world. Researchers have asked how to best characterize people's mental models of the natural world, how experience and goals influence people's mental models, and how these models influence reasoning and action (Medin & Atran, 1999). Another key focus has been to discover how folkbiologic concepts develop (Carey, 1985; Gelman & Kalish, 2006), and how they are shaped by language and belief systems (Angorro, et al., 2005; Astuti et al., 2004; Hatano & Siegler, 1993).

In this paper, we focus on the concept 'living thing' – a fundamental folkbiologic concept that includes members of both the plant and animal kingdoms. The developmental evidence reveals that this concept is difficult to acquire (Piaget, 1954; Hatano & Siegler, 1993; Angorro et al. 2005). For example, Piaget observed that young children tend to overattribute animacy, including inanimate objects (e.g., clouds, bicycles) that appear to move on their own. Researchers have also noted that young children tend to underattribute life, including animals but excluding plants from the set of entities that they judge to be alive. In previous work, we have argued that this difficulty reflects, at least in part, children's difficulty establishing the scope of these fundamental concepts and their relation to one another. We tied this difficulty to the naming practices of the languages to which children are exposed (Angorro et al., 2005). We focused on the role of naming because for infants as young as 9 months of age, naming has powerful consequences on conceptual organization, and named categories support inductive inference (see Waxman & Lidz, 2006, for a review).

In the current paper, we expand this claim, considering in addition, the contribution of cultural belief systems in the acquisition of the concept 'alive'. To foreshadow, we suggest that by roughly 6 or 7 years of age, children appreciate many of these fundamental concepts, but that they have difficulty working out the scope of these concepts (e.g., 'alive', 'living thing', and 'animal') and the relations among them. We claim that both the expression and the resolution to this difficulty reflect both the naming and belief systems of their communities.

Background

Animals, Living Things, and the Interpretation of 'Alive'

Consider the concepts 'animal', 'living thing', and the interpretation of 'alive'. We have suggested that there are strong commonalities in the mental models underlying these concepts, but that there are also intriguing cross-cultural and cross-linguistic differences. See Figures 1 &2.

In English (Figure 1), 'living thing' is comprised of two major constituent categories, 'animal' and 'plant'. However, the word *animal* has (at least) two senses, and these overlap in their scope. One sense (animal–inclusive) includes both humans and non-human animals; the other (animal-contrastive) includes only non-human animals. We have argued that this could have adverse consequences on acquisition (Angorro et al., 2005): If nouns support object categorization and induction, and if the same name points to two different nested categories, this should make it difficult for learners to identify the *scope* and relation of this word.

We suggest that English-speaking children may attempt to resolve this problem by avoiding it: mapping a unique term to each animal sense. In particular, children may (mis)appropriate the term *alive* to cover one sense (ANIMAL-INCLUSIVE), and the term *animal* to cover the other (ANIMAL-CONTRASTIVE). If this were the case, it could

[1] We adopt the following convention. 'Concepts' are marked with single quotes; *words* referring to them are marked with italics.

account, at least in part, for children's tendency to include animals (that is ANIMAL-INCLUSIVE), but not plants, when asked to identify living things. If this is the case, then the developmental trajectory should look different in a language that exhibited neither this overlapping category structure nor the polysemous use of *animal*.[2]

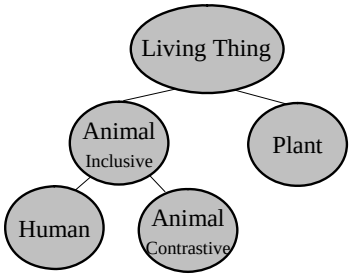

Figure 1: English. A Schematic Model

Indonesian provides a test case (Figure 2). In Indonesian, 'living thing' consists of three mutually exclusive categories, with no intervening node between these constituents and hence no polysemy. If naming practices influence the acquisition of these categories, then Indonesian-speaking children should not exhibit the same obstacles to working out the scope of 'animal' and 'alive' as has been documented in English, Hebrew, and Japanese (Hatano et al., 1993).

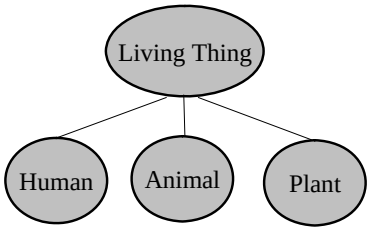

Figure 2: Indonesian and Tzotzil. A Schematic Model

Tzotzil Maya provides a different kind of test case. As in Indonesian, there is no overlapping term spanning both humans and non-human animals.[3] But unlike the Indonesian or US communities, the Mayan community belief system attributes life to certain natural kinds (e.g., sun, water). If children's emerging folkbiologic concepts are also influenced by culturally-shared belief systems, then the developmental trajectory should look different for children acquiring Tzotzil Maya.

Experiments

We tested these hypotheses in a series of experiments with children ranging from 4 to 10 years of age. Our US population included primarily majority-culture children attending urban and suburban public schools in the Chicago area. Our Indonesian population included children attending urban private and public schools in Jakarta. Our Tzotzil children were from a summer program in rural Chenalho.[4]

Task 1. "Could you call this an animal?"

We first checked our intuitions underlying Figures 1-2 by showing children from each community a picture of a person, and asking, "Could you call this an animal?". As predicted, Indonesian- and Tzotzil-speaking children responded categorically in the negative, suggesting that for them, people and animals are indeed mutually exclusive categories. English-speaking children responded differently: roughly 50% responded in the negative (animal-contrastive), and 50% in the positive (animal-inclusive). This is consistent with our prediction that English-speaking children appreciate both senses of the term *animal*.

Task 2. Predicate Sorting

To examine the content of children's folkbiologic concepts and the relations among them, we developed a sorting task with 17 cards, each depicting an entity, living or non-living. Children sorted these cards several different times, on the basis of different probes. In particular, they were asked to sort on the basis of whether the entities depicted a) were alive, b) could die, or c) could grow. Because each of these probes taps into a property of all living things, we reasoned that children's sorts would reflect the content of this concept. We characterized each child's pattern of response on each sort. We identified three primary patterns of response: (1) ANIMAL sorts were those in which the child included animals (but not plants). (2) LIVING THING sorts included animals and plants (but not natural kinds). (3) NATURAL KIND sorts included animals, plants, and natural kinds (but not artifacts). In assigning patterns of response, we permitted two errors. In the current analysis, we exclude children exhibiting no pattern.

Children in all three communities revealed an appreciation of an inclusive biological concept. More specifically, when they sorted on the basis of the predicates *grow* and *die*, children in all communities provided predominantly LIVING THING sorts. They distinguished living from the non-living things, placing humans, animals, and plants in the same category. However, when they sorted on the basis of the predicate *alive*, there were striking cross-community differences. See Figures 3-5.

First, as predicted, English-speaking children revealed a pointed and persistent difficulty interpreting the predicate *alive* and working out its relation to closely related categories. At age 4-5, children tend to interpret this term as referring to animals, but not plants. The tendency to include all living things increases gradually, but not dramatically with age. By age 9-10, fewer than 50% of the English-speaking children sort on the basis of living things.

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[2] Strictly speaking, these senses of *animal* may be autohyponymous rather than polysemous.

[3] In Tzotzil, but not Indonesian, the 'animal' concept is unnamed.

[4] There are several other differences among these three populations, including SES and direct experience with the natural world. In the current paper, we focus primarily on differences in language and cultural belief systems.

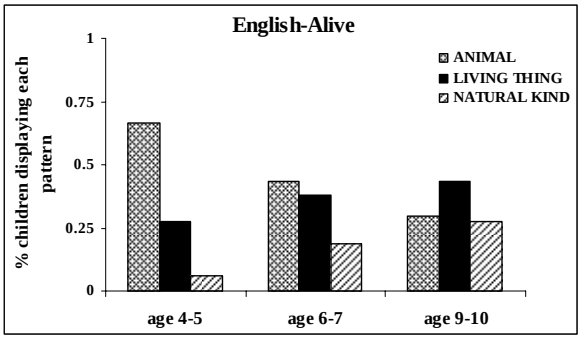

Figure 3: English Sorting Patterns

Second, Indonesian-speaking children reveal a very different developmental trajectory. As was the case in English, at 4-5 years they too prefer to extend this term to animals (and not plants). However, in this population there is a marked increase in LIVING THING sorts: by 9-10 years, they interpret *alive* as referring to all living things. We tie this difference between English- and Indonesian-speakers interpretation of *alive* primarily to differences in naming practices.

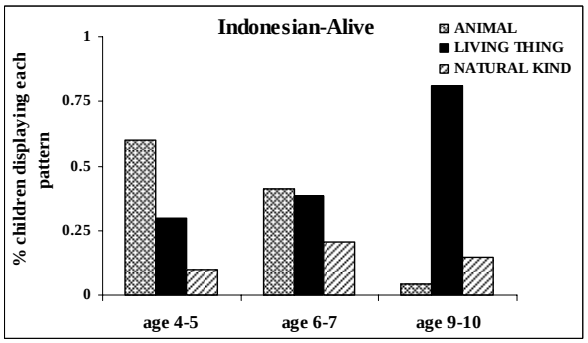

Figure 4: Indonesian Sorting Patterns

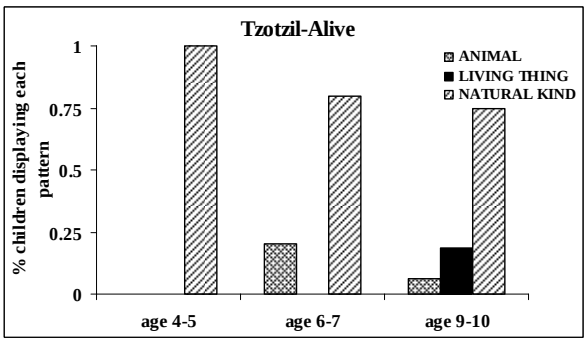

Figure 5: Tzotzil Sorting Patterns

Third, Maya children speaking Tzotzil reveal yet a third developmental trajectory. Although the structure of the Tzotzil naming system resembles that of Indonesian, Tzotzil speakers endorse a broader interpretation of *alive*, one that includes certain natural kinds -- the sun, clouds, and water -- that are considered to be inanimate in the English and Indonesian communities. This interpretation is evident at 4-5 years and persists throughout our developmental window, although by 9-10 years, children begin to entertain a different interpretation which includes plants and animals but excludes these other natural kinds. In future work, we will pursue this phenomenon in older children and adults.

Conclusions and Future Directions

We suggest that these cross-community developmental differences reflect the naming practices and belief systems in each respective community. In closing, we will discuss the implications of this work for theories of development, identify avenues for future research, and highlight the advantages of combining psychological, linguistic and anthropologic methods in developing theories of acquisition.

Acknowledgments

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Cultural Aspects in the Development of Children's Understanding of Folkbiology

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Abstract

Developmental research has often focused on detecting universals of human thought. However, recent research indicates the need to expand our research with respect to two aspects: First, we need to enlarge our data-base beyond the standard population (white middle class urban children). Second, in order to understand children's development we need to better understand the context of knowledge acquisition. In the latter approach culture is no treated as an independent variable, but has a distributional character. Here the focus is not on the comparison of mean differences between groups, but on tracing patterns of agreement and disagreement of wider social processes.

A Distributional View of Culture

Most definitions of culture include the sharing of norms, ideas and models. In this view culture is often described as the things one has to learn to function properly within a culture. The problem with this approach is twofold: First, it is not clear why agreement between members of a culture should be a priori assumed. Second, in this view – and following the line of assumed agreement – culture is treated as a clearly bounded unit, an independent category that is left over when we tested for all other variables we could think of (age, gender etc.). Within such an approach, researchers usually treat disagreement (deviation from the mean) as noise rather than information with respect to the acquisition of knowledge. While this approach has some merit it introduces two potential mistakes. First, it ignores differential input conditions among the children within any given group overemphasizing agreement. At the same token, age differences are given disproportional weight compared to differences in expertise and learning conditions etc. Second, failing to explore within cultural differences might prevent us from understanding specific conditions that lead to larger group differences. Such differences are often essentialized by attributing them to a "mysterious force" – culture. In this scenario culture is treated as an independent variable, essentialized (that what is left when we run out of other variables to think of) resulting in a circular argument: X shows a certain behavior because he is part of the culture Y. (see Medin et al. 2002).

Rather than studying culture as an independent variable we should focus on understanding underlying processes of knowledge acquisition, transmission and change (Atran, Medin & Ross, in press; Ross 2004). In this view culture has to be studied as causally distributed patterns of mental representations, their public expressions, and their resultant behaviors in given ecological contexts. In other words we have to explore the pathways that lead to agreement and disagreement. In this view, agreement becomes an emerging property, which has to be explained, rather than assumed.

This approach does not ignore developmental patterns based on age, but adds an additional focus on the social factors of knowledge acquisition. Instead of treating disagreement (deviation from the average or majority response) as noise, understanding deviations as the result of specific socio-cultural factors (experience, knowledge transmission etc.) or the lack thereof becomes part of our task. In order to do so we need to move into an ethnographic experimental mode that provides us with important data about the children we are working with. We also need to explore subject pools beyond Psychology's standard population in order to test for parameters such as number of siblings, parental occupation and interest etc. Studies with adults seem to provide a good guide for such research.

Expertise and Culture

A large body of data with adults clearly shows the importance of expertise with respect to categorization and reasoning (see for example Medin et al. 1997). At the same time cultural models appear to provide the framework that guides knowledge acquisition (Gelman & Wellman 1992). For example, in studies conducted among Menominee and Majority Culture fishing and hunting experts in rural Wisconsin we found clear differences with respect to existing epistemological frameworks that make specific knowledge more salient than others (see Medin, Ross et al. 2006; Medin, Ross & Cox, in press). Interestingly, we found similar differences between young children of the two populations. As for the Menominee experts (compared to their Majority counterparts), ecological knowledge seems to be more salient for Menominee children than Majority Culture children (Ross et al. 2003). On the other side, we did not find this effect for all the Menominee children.

As outlined above there is no reason to a priori assume shared knowledge among members of a community. In fact, the lack of agreement is what allows for processes such as cultural change. For example, in previous research I documented clear intergenerational differences among Lacandon Maya in Chiapas (Ross 2002). These differences were explained based on different conditions in the upbringing of the individuals involved. However, the study site did not allow for an explicit study of child development.

Methodological Issues

From the above it should be clear that I am not arguing that age is not an important factor in the development of children. I am arguing, however, that developmental trajectories very

likely look very different across different settings. I am also not arguing that children do not make mistakes or that our data contain no noise at all. Instead I am arguing that we need to be careful in examining our data before declaring a large percentage of responses as noise. To avoid such mistakes we need more information both in experimental and ethnographic form about the children we are working with.

Clearly more extensive data gathering methods are needed to improve our understanding of child development. In addition, we need tools to analyze levels of agreement within and across the age sets studied (both within and across the cultural groups). The cultural consensus model (CCM; Romney et al. 1986) has proved to be a powerful tool to estimate levels of agreement and disagreement. It is basically a factor analysis (principal component analysis) over individuals' responses. If the data are expressed in a strong single-factor solution (with no negative first factor scores) we can assume a high level of agreement among the individuals. First factor scores allow us an estimate of each persons participation in the consensus – that what everyone knows – and in an extension allow us to make predictions with respect to agreement of individuals based on their participation in the consensus (product of the first factor scores). This predicted agreement can be checked against the observed agreement, allowing us to test whether specific social factors (same friends etc.) lead to higher than expected agreement.

Tzotzil Maya folkbiology

The Tzotzil Maya are corn and coffee farmer living in the highlands of Chiapas. While most people still farm to some extent, many people have shifted to other income generating activities, such as work in the service sector, small business etc. Chenalhó, the community where this study took place is a fairly rural community and independent of parents occupations children get exposed from an early age on to agriculture and animals – chicken and cats are seen almost around or inside every house. Even this short description of the community should make it clear that the children of Chenalhó differ quite a bit from our standard populations. In addition there are many differences in cultural beliefs among adults as reported in multiple ethnographic reports of the area. It should not come as a surprise that the developmental trajectories with respect to understanding folkbiology look quite distinct from the ones traditionally described for children in the USA. While expertise might play a big role in explaining such differences it is equally important to explore existing adult models, as these models very likely provide some of the input conditions for child learning. Finally, it is clear that within the community not all the children have the same exposure to the biological world and not all individuals are equally exposed to the kind of cultural beliefs described in ethnographic reports. As such we might expect differences between children both with respect to experience and their mental models of the world.

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Influence of Language, Culture, and Universal Cognitive Constraints on the Everyday Object Concepts

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Introduction

Whether and to what extent our conceptual structure is universal is of great importance for our understanding of the nature of human concepts. Concerning the linguistic factor, we tested whether a grammatical categorization system by classifiers, which classify objects in the world very differently from the way nouns do, influence the structure of everyday object concepts in speakers of classifier languages. Concerning the culture factor, we tested a specific proposal by Nisbett and colleagues (e.g., Nisbett, 2003), which predicts that Westerners organize object concepts around taxonomic relations while Easterners organize them around thematic relations. For this purpose, we tested children and adults speaking a classifier language, Chinese, and those speaking German, a non-classifier language, on a range of tasks including categorization, similarity judgment, novel label extension, and property induction.

Like nouns, classifiers linguistically categorize entities in the world. However, the lexical organization of classifiers is very different from that of nouns. While the noun lexicon is organized by taxonomic relations, the classifier lexicon is organized around semantic features such as animacy, shape, dimensionality, size, functionality, and flexibility. Categories made by classifiers often crosscut taxonomic categories, although functional classifiers in part overlap with them. For example, *tiao*, a Chinese classifier for long and flexible things, even crosses the animal and non-animal ontological boundary, including fish, dogs, rivers, roads, pants, and more, in the set of the things it classifies. An extremely interesting question is whether classifier categories affect conceptual structures in speakers of a classifier language.

We explored this issue by testing both children and adults. In a developmental study, we studied Mandarin Chinese- and German-speaking three- and five-year-olds and adults on no-word classification, novel-noun label extension and inductive inference of novel properties.

Crosslinguistic Developmental Study

To examine (1) whether classifier categories affect young children's cognitive activities such as category making and inductive reasoning, and if the answer to the first question is yes, (2) whether and how this effect interacts with the nature of the task context, we tested Chinese and German-speakers in three age groups (3-year-olds, 5-year-olds, adults) on a match-to-the standard generalization paradigm in three different contexts: no-word classification, label extension and property inference. Three kinds of relations, taxonomic relations, shape similarity, and thematic relations, have been described as major organizers of young children's concepts. Among the three relations, shape similarity is one of the most important semantic features underlying the classifier categorization system in Chinese as well as in other classifier languages. The contrast between taxonomic and thematic relations is of interest not only in light of traditional theories of conceptual development (e.g., Smiley & Brown, 1979; Markman, 1989; Waxman & Namy, 1997) but also in light of recent proposal by Nisbett and colleagues on cross-cultural cognition (e.g., Nisbett, 2003). Nisbett and colleagues hypothesized that East Asians, with their predisposition to see a scene or event as a whole, are expected to categorize the world around thematic relations; Westerners, with their focus on properties of individual objects, are expected to categorize the world by taxonomic relations.

In all three contexts (i.e., no-word classification, label extension, property induction), a child was shown a picture of the standard object (e.g., banana), and was asked to choose one item out of the three choice items: a taxonomic item (grape), a shape item (feather) and a thematic item (monkey). In no-word classification, the participants were asked to select the item that best matches the standard object. In label extension, the participants were asked to extend a novel label that was given to the standard. In property induction, a novel non-perceptual property about the standard object was taught, and the participants were asked to select the item that would be most likely to have the same property.

We found that Chinese preschoolers used shape similarity as a basis for no-word categorization at a higher rate than German preschoolers (table 1), which supports the idea that classifier categories may affect young children's categories beyond the context in which classifiers are invoked. Second, however, this cross-linguistic difference was not observed in the label extension or property inference tasks. In the former case, not only Chinese but also German-speaking children predominantly extended novel labels on the basis of shape similarity, replicating the results with English-speaking children in previous similar studies (e.g., Imai et al., 1994). In the latter case, children did not rely on shape in generalizing a novel property to other objects. In fact, both Chinese and German 5-year-olds generalized the properties on the basis of taxonomic relations to the same degree as adults did, confirming that young children, just like adults, assume that taxonomic categories carry high inductive potential, while perceptual similarity does not (e.g., Gelman and Markman, 1986).

Table 1. Results of the Developmental Study: Mean proportion in each task, language, and age.

	Chinese			German		
	Taxonomic	**Shape**	**Thematic**	**Taxonomic**	**Shape**	**Thematic**
No-word						
3-Year	31.8%	52.6%*	16.7%*	42.8%	25.6%	33.3%
5-Year	15.6%*	47.4%	37.0%	19.4%*	17.8%	62.8%*
Adults	26.7%	25.0%	48.3%	43.3%	5.0%*	51.7%*
Label ext.						
3-Year	28.2%	63.4%*	8.3%*	27,8%	57.8%*	14,4%*
5-Year	27.9%	61.3%*	10.8%*	32.2%	56.7%*	11.1%*
Adults	57.5%*	30.8%	11.7%*	78.0%*	16.7%*	5.3%*
Property Ind.						
3-Year	41.7%	37.5%	20.8%$^{+}$	41,7%	34,4%	23,9%
5-Year	64.1%*	27.6%	8.3%*	65.0%*	18.3%*	18.9%*
	79.2%*	14.2%$^{+}$	6.7%	90.8%*	8.3%*	0.8%*

*Denotes significantly different from chance level, $p<.05$; $^{+}$Denotes marginally different from chance level, $p<.1$

The pattern of results suggests that the classifier system may indeed affect Chinese children's categorization, but the effect is limited to a context in which the type of information/knowledge to be processed for the task is left ambiguous (as in no-word categorization). When the task constrains the kind of knowledge to be accessed, the language-specific effect of classifiers seems to disappear (as in novel-label extension and property induction).

The results of this study did not support the culture-specific cognition hypothesis (e.g., Nisbett, 2003). In general, Chinese and Germans preschoolers did not differ in respect to their taxonomic or thematic choices. In particular, in the no-word classification context, German 5-year-olds predominantly made thematic responding while Chinese children made shape responding most frequently.

There was no difference between the two language/culture groups in any of the three tasks in adults. Both Chinese and German adults mostly made the taxonomic choice in the label extension and the property induction tasks; however, they made thematic choices more often over taxonomic choices. However, this may be because the forced-choice-match-to-sample paradigm was not sensitive enough for examining cognitive processes in adults. In fact, in our previous study with Chinese and German adults (Saalbach and Imai, 2005) using similarity judgment on a rating scale, Chinese adults rated objects from the same-classifier categories more highly than German speakers. Thus, there seems to be a subtle influence of a classifier categorization system in adults as well.

General Discussion and Conclusions

What was most notable among the findings from this research was cross-linguistic/cultural similarity rather than differences between Chinese and Germans: Speakers of both languages utilized different conceptual relations in the same way across different cognitive tasks. The results of the current research as well as our previous research (Saalbach and Imai, 2005) demonstrated some degree of influence of classifier categories on Chinese speakers. At the same time, our findings cast serious caveat against a simply Whorfian-vs.-non-Whorfian dichotomy, as the effect of language-specific categories is limited in magnitude when compared to other major conceptual relations such as taxonomic and thematic relations, and largely interacts with task-specific cognitive constraints and background knowledge. Beyond the context of cross-linguistic/cultural cognition, this research also points to the importance of accessing conceptual structures by looking at the whole pattern of behavior on multiple cognitive tasks, rather than drawing a conclusion from results of a single cognitive task.

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Opening the Black Box on Language, Culture, and Thought

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The behaviorist era was a time of rapid accumulation of knowledge about how environmental conditions were related to behavioral responses acquired through learning. Despite the optimistic term "learning theory" for the explanations that accompanied the observations, though, the behaviorist endeavor yielded little by way of compelling accounts of what linked the inputs and outputs. The black box was eventually pried open by the dual developments of the computational metaphor of mind and experimental techniques for probing the mental representations and processes that intervened between input and output, and these changes stimulated the development of more satisfying theories.

The study of the relations among language, culture, and thought has a long history, and many fascinating observations have likewise been made about the relations between what we might call the input and output – specifically, between language and thought, on the one hand, and culture and thought on the other. But much of this work has had a distinctly black box character to it. For instance, the bulk of the extensive literature on whether the different color vocabularies of languages result in differing color perception or cognition has asked only exactly that: Suppose we look at people who speak languages that carve up the color spectrum differently; do we see differences in their behavior on a variety of color-based tasks? Similarly, work in other lexical domains has asked questions such as, If we look at people who speak languages that mark nouns for gender vs. those who don't, do we see differences in how they think about the entities referred to by the nouns? Interest in the relation between culture and thought is of much more recent vintage among cognitive psychologists, but here, too, these investigations have had a black box character. They frequently ask only whether global properties of cultures -- such as whether they are more individualist or collectivist, or have a closer or more distant connection to nature -- are reflected in the way that members of the culture respond to certain tasks.

The black box approach to these issues has without doubt contributed to the slow progress in developing a deeper understanding of the relations among language, culture, and thought. While observations pile up, little by way of theory has been offered to provide a framework for making sense of the individual outcomes taken together, or to guide the search for further information. By what mechanism(s), exactly, would characteristics of cultures as a whole exert an influence on individual cognition? By what mechanism(s) might having certain types of linguistic representations and not others shape the nature of non-linguistic representations or processes? The lack of theory is especially surprising against the backdrop of the cognitive revolution -- by now hardly news -- and the sophisticated theories and models of mental life that have arisen not only in other domains (e.g., memory, attention, categorization) but also linking knowledge of language to thought in the service of other goals, such as understanding speech production (e.g., Levelt, Roelofs, & Meyer, 1999), word meaning (e.g., Vigliocco, Vinson, Lewis, & Garrett, 2004) or uncovering the nature of thought itself (Jackendoff, 1983). However, the challenges to developing theories are perhaps greater for the task of understanding the relations among language, culture, and thought than in other areas of cognitive inquiry, as I will discuss later.

Fortunately, the papers by Ross, Waxman & Medin, and Imai & Saalbach present steps toward a more satisfying approach to understanding the relations among language, thought, and culture. Ross directly takes up the problem of how general characterizations of culture can be linked to individual thought. He rejects traditional definitions of culture that view culture as a set of beliefs, values, customs, etc., common to a group of people. Rather, he proposes that culture be construed as causally distributed patterns of mental representations, their public expressions, and their resultant behaviors in ecological context. This view of culture suggests that research should focus on understanding how knowledge is acquired, transmitted, and changed. As such, it encourages us to trace the distribution of patterns of knowledge and beliefs both across and within cultures in order to establish the pathways that determine how ideas affect behaviors and vice versa (Atran, Medin, & Ross, 2005). Following this approach can provide the foundation for development of models and theories that have explanatory force with regard to how culture may affect thought, and that provide the basis for guiding further research.

Waxman & Medin and Imai & Saalbach present empirical investigations in which they ask what capacities children bring to the task of acquiring knowledge, and how language and culture may shape the task they are faced with or the information they take in. Both of these investigations illustrate a point that must be taken seriously if we are to develop theories of how language and culture may influence thought. Namely, there may not be a fixed representation we can point to in trying to describe what knowledge a child (or adult) has. Imai and Saalbach demonstrate compellingly that depending on what kind of task is used to tap knowledge, different patterns of responses may occur. When a child is asked merely to choose what object goes with another, she

may make a different choice than when asked what object shares a property with the first or what object shares the same name as the first. Given this observation, what constitutes the "concept" that the child has in that domain? (see also Barsalou, 1987; Malt & Sloman, 2006). Waxman & Medin's data suggest the same dilemma. Strikingly, children from the US, Indonesia, and Mexico show uniformity in their judgments about what things grow and what things die. Given that growing and dying are key elements of being alive, these responses suggest that the children have similar understanding of what it means for something to be alive. On the other hand, they made substantially different judgments when asked directly about what things are alive. Do they have the same understanding of aliveness or not? There clearly is no single answer to these questions, and a model of the relations among language, culture, and thought will need to represent elements of knowledge and how they are retrieved in the service of tasks such that different ensembles of elements can be recruited in different tasks (Barsalou, 1987). The model will also need to provide mechanisms that account for which elements are retrieved under what circumstances, and when (or if) language and culture influence the retrieval process (as well as when or if they shape the underlying representations that they act upon).

The preceding observation raises another issue that will need to be resolved in order to develop theories or models. Intuition tells us that there is such a thing as a concept of "alive", so how can we get two different answers depending on what the task is? I believe the answer is that this intuition comes about because we tend to confuse the knowledge associated with words with the contents or structure of non-linguistic representations. We often say things like "Speakers of Russian have different color concepts from speakers of English" based on the observation that the lexicons of the two languages differ in the ways they label color. That is, we talk as if a difference in the meaning associated with words is the same thing as a difference in non-linguistic representations.

But if we adopt this sense of the term *concept*, we are faced with a theoretical incoherence. This sense entails that all observed difference between languages automatically yield differences in concepts. If we take that as the relevant sense for our theorizing, there is no need for any debate about what the relation is of words to concepts, nor for any empirical evaluation of the hypothesis that language shapes thought. Yet these issues are, of course, at the very heart of the research enterprise concerning the relations among language, culture, and thought. I suggest, then, that we need to be careful to refer to the cross-linguistic differences in the knowledge associated with words in different languages as differences in *linguistic* concepts (or *semantic* concepts, or word meanings), and to test, not assume, consequences for non-linguistic knowledge content, organization, or use.

Using this terminology, the children speaking English, Tzotzil, and Indonesian in Waxman & Medin's study may have very similar knowledge about crucial properties of plants, animals, humans, and artifacts. What differs is the level of success they have achieved at a given age at figuring out what elements of that knowledge are associated with the English word *alive* or its approximate equivalent in the other languages. Then the answer to the question of whether the children have the same understanding of aliveness or not is simple: They have the same understanding of the nature of the entities under discussion, but they differ in their lexical competence in the domain.

But working out such details is the easy part. The real reason that developing theories and models of the relations among language, culture, and thought will be such a challenge is what else they will need to include. So much of the influence language and culture may have on thought may be exerted during childhood that capturing developmental trajectories will be essential. As Imai & Saablach's paper illustrates, we must understand what aspects of development are malleable and what are less so. As Ross has pointed out, patterns of input must also be understood, as must the ecological context of the output measured. And as Waxman & Medin's data indicate, the patterns of input modeled must capture not only what information is transmitted but in what linguistic forms – differing across languages – it is offered. The black box will not be flung open. It will be cracked open bit by bit. But it is time to take the pry bar and get to work.

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