CHAPTER 1

The Role of Language and Culture in Universality and Diversity of Human Concepts

MUTSUMI IMAI AND TAKAHIKO MASUDA

Abstract

The influence of language and culture has been investigated across different research disciplines such as anthropology, cognitive psychology, and cultural psychology, but such research all tends to ask whether language (or culture) influences cognition in general, without clearly specifying what is meant by "language" or "culture." This chapter proposes an alternative approach, whose aim is to specify a complex interplay among various factors—including universal cognitive constraints, perceptual affordances provided from the world, task-specific constraints, language-specific biases, and culture-specific cognitive styles—to account for people's behavior in a given cognitive task and the developmental trajectory of that behavior. To establish this point, four research programs examining the roles of language and culture in terms of construal and organization of objects, relations among objects, and actions are reviewed.

Keywords: Whorfian hypothesis, conceptual development, lexical development, conceptual universals, object categorization, count-mass, taxonomic relations, thematic relations, classifiers, lexicalization patterns, verb learning

I. INTRODUCTION

One of the key quests of cognitive science is to understand both the universality and the diversity of human conceptual structures and cognitive processes. The overall goal of this chapter is to provide a new framework to investigate the role of language and culture in human cognition, by reviewing a program of research that investigated this issue across several different conceptual

domains. Specifically, we address how two major factors—language and culture—uniquely or interactively affect conceptual representation and cognitive processes.

The influence of language and culture on cognition has been investigated across different research disciplines such as anthropology, cognitive psychology, and cultural psychology (a subdivision in social psychology). These disciplines are interested in different aspects and levels of cognition using different methodologies, but they all tend to treat language and culture without clearly specifying what they mean by "language" or "culture." Furthermore, they tend to approach the issue in a simple black-and-white fashion, simply asking ***whether*** language (or culture) influences cognition in general.

We propose an alternative approach that assumes a complex interplay among various factors—including universal cognitive constraints, perceptual affordances provided from the world, task-specific constraints, language-specific biases, and culture-specific cognitive styles—to account for people's behavior in a given cognitive task. Here, the goal of research is not to determine ***whether*** but rather to specify ***how*** particular aspects of language or culture interact with one another or interact with universal cognitive biases and constraints, the structure of the world, and constraints placed by the task (e.g., what type of information or knowledge is most relevant for the inference).

In sections II through V, we review our research programs, which extended across four conceptual domains: (1) how we construe entities and classify them as objects and substances (Imai & Gentner, 1997; Imai & Mazuka, 2007); (2) how we utilize and weigh three types of conceptual relations—taxonomic relations, thematic relations, and classifier relations—in engaging cognitive tasks (Imai, Saalbach, & Stern, 2010; Saalbach & Imai, 2007, 2011); (3) how we map objects and actions onto nouns and verbs and how we generalize novel nouns and verbs (Imai, Haryu, & Okada, 2005; Imai, Li, Haryu, Okada, Hirsh-Pasek, Golinkoff, & Shigematsu, 2008); and (4) how we talk about action events and how language-specific lexicalization patterns are related to attention to the objects and background of action scenes (Maguire, Hirsh-Pasek, Golinkoff, Imai, Haryu, Vanegas, … Sanchez-Davis, 2010; Göksun, Hirsh-Pasek, Golinkoff, Imai, Konishi, & Okada, 2011). In all four programs of research, the complex relations among language, culture, and universally shared cognition are specified based on evidence from cross-linguistic experiments, and the developmental trajectory of language and culture-specific cognition is addressed. In section VI, we integrate the findings from the four lines of research programs.

Before going into our research programs, however, we briefly review how the influence of language and culture has been investigated in the disciplines of cognitive psychology and social psychology, respectively.

A. Relation Between Language and Thought: The Whorfian Hypothesis

Many studies have been conducted to address whether language influences people's concepts and cognitive processes at the lexical, grammatical, or discourse level. (For reviews, see Boroditsky, 2001; Bowerman & Levinson, 2001; Chiu, Leung, & Kwan, 2007; Gentner & Goldin-Meadow, 2003; Gumperz & Levinson, 1996; Hunt & Agnoli, 1991; Kashima & Kashima, 2003; Lucy, 1992; Malt & Wolff, 2010). The question concerns ***linguistic relativity***, or the ***Whorfian hypothesis*** (Whorf, 1956), an hypothesis named after sociolinguist Benjamin Lee Whorf. Noting diversity across different languages, and in particular through his observations of the drastic differences between native American languages such as Hopi and those he called Standard European Languages (SEL), Whorf argued that our perception of the world is like a "kaleidoscopic flux of impressions" and that language can carve these perceptions in any arbitrary way. In this sense, language determines thought.

A massive body of research has examined the influence of linguistic categories on thought, and the strongest interpretation of linguistic determinism (that the linguistic forms of one's language determine what ~~it~~ is possible to think) has long been abandoned. Still, there are ongoing disagreements among researchers regarding the Whorfian hypothesis. The hypothesis has been approached in two ways (see Imai & Mazuka, 2003, 2007, for fuller discussions). The traditional approach is to select two or more language groups that differ in a linguistic categorization—be it grammatical categorization of objects, spatial relations, or color—and to then compare the speakers' performance in cognitive tasks that should reflect linguistic categories (for reviews, see Bowerman & Levinson, 2001; Gentner & Goldin-Meadow, 2003; Malt & Wolff, 2010).

For example, in the domain of color perception, researchers have asked whether speakers of a language that does not distinguish "blue" from "green," or a language that has two distinct basic-level labels for ***blue*** (roughly "lighter blue" and "darker blue"), perceive the regions of the color band corresponding to what English speakers call "blue" and "green" differently (Davidoff, Davies, & Roberson, 1999; Roberson, Davies, & Davidoff, 2000; Tierry, Athanasopoulos, Wiggett, Dering, & Kuipers, 2009; Winawer, Witthoft, Frank,

Wu, Wade & Borodistky, 2007). Time is another conceptual domain that has attracted much attention. For example, researchers have asked whether Chinese speakers, whose language expresses temporal order of events not only along the horizontal axis (before and after) but also along the vertical axis (up and down), construe timelines differently from English speakers (Boroditsky, 2001; Chen, 2007; January & Kako, 2007). In neither domain, however, has a decisive conclusion been reached. Whereas some researchers argue that their data support the Whorifan hypothesis (e.g., Boroditsky, 2001; Davidoff et al., 1999; Roberson et al., 2000), others present evidence against it (Chen, 2007; January & Kako, 2007; Regier, Kay, & Cook, 2005).

The Whorfian hypothesis has been debated in another venue as well. Researchers have investigated the relation between language development and conceptual development, asking how language acquisition changes children's concepts and cognition. If children's concepts and cognitive processes are greatly changed through learning a language, this might be considered as evidence for the Whorfian hypothesis (e.g., Carey, 2001; Gentner, 2003; Spelke, 2003). For example, young children prefer to form categories based on thematic relations (e.g., dogs and things that are seen with dogs). However, as they learn language, they become aware that labels pick out taxonomic relations rather than thematic relations. This consequently leads them to form categories based on taxonomic relations even without the invocation of labels (Imai, Gentner & Uchida, 1994; Markman, 1989).

If children learn to classify and organize the world through language learning, then given the fact that linguistic categories are diverse across different languages, the resulting concepts and cognitive processes should be diverse and specialized to the particular languages the children are learning (e.g., Bowerman & Choi, 2001; Göksun et al., 2011; Lucy & Gaskins, 2001). For example, the English language categorizes spatial relations with respect to containment or support but not with respect to whether two objects (i.e., figure object and ground object) are in tight-fit or loose-fit relation; the Korean language however, does specify such a relation. English-reared infants are originally sensitive to perceptual difference in tight-fit and loose-fit relations (Hespos & Spelke, 2004). However, as they learn their native language, they lose their sensitivity to the tight-fit/loose-fit difference between two cases in which the figure object is contained by the ground object: the case in which something is loosely contained in something (e.g., an apple in a bowl) and the case in which there is tight-fit containment (e.g., a finger in a ring) (Choi, McDonough, Bowerman, & Mandler, 1999).

Although developmental researchers in general agree that language propels conceptual development in children, again, there are a group of developmental researchers who are antagonistic to the Whorfian hypothesis. They argue that reported cross-linguistic (or cross-cultural) differences do not deserve serious attention or consideration for understanding the nature of human cognition (e.g., Gleitman & Papafragou, 2005; Li & Gleitman, 2002; Pinker, 1995) in the face of innate and universal conceptual building blocks with which human infants are endowed, as demonstrated by the finding that not only Korean but also English-reared infants can distinguish the tight-fit and loose-fit relations between two objects (Hespos & Spelke, 2004). In other words, all infants have the ability to learn language along more or less the same path, regardless of the culture and language they are raised in. Therefore, diversity due to language differences should be negligible (e.g., Bloom, 2000; Li, Dunham, & Carey, 2009; Pinker, 2007; Soja, Carey, & Spelke, 1991).

In summary, there have been disagreements about the universality and diversity of human cognition, and the debate about the Whorfian hypothesis is far from being settled. It makes intuitive sense that human cognition has both universal and language- or culture-specific aspects. The disagreement to a large extent reflects researchers' preference for highlighting either the commonalities or the differences, when in fact there are always both. However, the Whorfian hypothesis has been treated largely in a black-and-white fashion, and relatively little effort has been made to specify the exact scope of cross-linguistic differences in a global picture of human cognition.

In this chapter, we address the issue of relations between language and cognition from a standpoint in the middle, between the universalists and the language determinists; we assume that universality and diversity are both present in human cognition. As stated earlier, our goal is not to determine whether the Whorfian hypothesis is right or wrong. Rather, we attempt to specify the relative magnitude of universality and of language- or culture-specific diversity and how the latter arises in the complex interactions among various factors residing both inside humans and out in the world.

B. Relation Between Language and Culture

The relation between language and culture has also not been adequately addressed. Researchers' lack of consensus regarding the role of language and culture in human concepts and cognitive processes stems largely from the fact that the subdisciplines define language and culture differently. These definitions, in turn,

constrain their research and their conclusions. Many researchers, particularly those who investigate the Whorfian hypothesis within the tradition of cognitive psychology, tend not to consider the influence of culture or how language and culture interact with each other. Other researchers, mostly sociocultural psychologists who follow the social psychology tradition and hence are more interested in the role of culture in shaping people's behavior and cognitive dispositions than that of language, have largely conflated language with culture (e.g., Hamilton, Gibbons, Stroessner, & Sherman, 1992; Kashima & Kashima, 1998). Cognitive psychologists tend to test the influence of specific linguistic categories of narrow scope, whereas sociocultural psychologists examine the influence of language defined in a broader sense—often language as a whole as a tool for communication (Chiu et al., 2007). Although both types of psychologists talk about the influence of language, what they mean by "language" is often very different.

The relation between culture and language has been oversimplified as well. We do not mean to say that no meaningful conclusions can be drawn about the general role of language and culture in human cognition. However, researchers need to be much more careful in specifying what the terms ***language*** and ***culture*** mean.

In this chapter, to specify the role of language and culture and to avoid confounding of the two factors as much as possible, we take the cognitive psychology approach, with ***language*** defined as specific grammatical or lexical categories as stated earlier, and we discuss the ***influence of language*** in a narrow and limited sense (i.e., the influence of the particular target linguistic category being dealt with). Likewise, we define the ***influence of culture*** in a specific sense, largely following a prevalent cultural model of cognition in East Asians and Westerners in the cultural psychology literature (e.g., Nisbett, 2003; Nisbett & Masuda, 2003; Nisbett, Peng, Choi, & Norenzayan, 2001). We then address the influences of language and culture separately whenever possible, but we also discuss how the two work conjointly. At the end of the chapter, we broaden our perspective and discuss the role of language and culture in the broad sense—how language embedded in a particular culture as a whole is related to our mode of communication and thinking.

II. LINGUISTIC/CULTURAL UNIVERSALS AND DIVERSITY IN THE CONSTRUAL OF OBJECTS AND SUBSTANCES (RESEARCH PROGRAM 1)

In this section, we present research that examines whether systematic grammatical marking of individuation (i.e., count/mass grammar) influences speak-

ers' ontological concepts or construal of novel physical entities. We compared Japanese-speaking children and adults with English-speaking age counterparts to test three possibilities. The first possibility is that, as language deterministic theorists maintain, the presence of count/mass grammar leads to fundamentally different concepts about physical entities. The second possibility (the middle ground position) is that count/mass grammar does not lead to fundamentally different ontological concepts but does affect speakers' attention to certain perceptual dimensions (e.g., whether people attend to the shape of the physical entity or the materials of which the physical entity is made). The third possibility is that, as language universalists maintain, the presence or the lack of count/mass grammar does not affect speakers' conceptual understanding of objects and substances at all. Based on the findings of Imai and her colleagues (Imai & Gentner, 1997; Imai & Mazuka, 2007), we maintain the second possibility. At the end of the section, we discuss the magnitude of the effect of culture rather than language on this phenomenon.

A. Linguistic Diversity in Coding the Count/Mass Status of Entities

Objects (e.g., cup) and substances (e.g., clay) have fundamentally different criteria for the notion of "sameness." When we talk about whether two ***objects are the same,*** we are referring to two objects in their entirety, and not to two distinctive parts of a single object. The word ***cup*** is applied to whole objects of a similar "cup" shape, regardless of color or material components, that can potentially contain liquid. If a cup is broken into pieces, each piece no longer constitutes a "cup." In contrast, when we talk about whether the two ***substances are the same***, we do not judge based on the notion of entirety, because there is no such thing as "whole sand," "whole water," or "whole clay" (cf. Quine, 1969). Different from the word ***cup***, the word ***clay*** is extended to any portion of clay, regardless of shape.

In many languages, there are grammatical markers that differentiate objects from substances. For example, in English, object names are linguistically marked as count nouns, whereas substance names are marked as mass nouns, and people can detect whether the name for the target entity is a count or a mass noun based on these markers (e.g., whether we use "a" or " a piece of") (Wierzbicka, 1988). In contrast, languages called ***classifier languages*** classify all nouns (i.e., not only mass nouns in the English sense but also count nouns) by using special grammatical markers such as "a piece of" in English (Imai, 2000; Imai & Gentner, 1997; Imai & Mazuka, 2007; Lucy, 1992); these

languages treat individuation in quite a different manner from English. For example, in the classifier language Japanese, if *X* denotes a noun, then in the sentence, *Kore* (This) *wa* (Topic particle) *X desu* (IS-polite), meaning "This is X," *X* can, among other things, refer to either an object or a substance. Japanese also does not make the singular/plural distinction. In the absence of context, someone hearing the sentence *Kore wa X desu* would not know whether X referred to one or multiple items (see also Imai, 1999; Imai & Haryu, 2001).

In English, substances are quantified by explicitly providing a unit of quantification (e.g., two *glasses* of water, two *bottles* of water). In languages such as Japanese, classifiers provide a similar function (Craig, 1994). But importantly, this numeral + classifier construction is not limited to what are considered mass nouns in English; it is required for quantifying *any* noun, including count nouns that denote apparently individuated entities such as people, animals, cars, or chairs, as in the phrase, *2-hiki no neko* (2 *hiki*—classifier for small animals, *no*—genitive marking particle, *neko*—cat). Given these observations, in classifier languages, nouns in general, including those clearly referring to individuated objects, have often been characterized as mass nouns for which a unit of individuation is explicitly given (e.g., Chierchia, 1998; Lucy, 1992; Quine, 1969; but see Cheng & Sybesma, 1998; Yi, 2009). For example, Quine (1969) noted that the Japanese word *ushi* may be more closely translated as the English mass noun *cattle* rather than as count nouns *ox* or *cow*, because when *ushi* is quantified, it needs to be individuated by the classifier *tou* ("head"), for example in a phrase such as *5-tou no ushi*.

B. Psychological Consequences of Linguistic Diversity: Quinian or Whorfian Relativity

To what extent do the differences in syntactic structure influence people's cognitive processes? A radical version of linguistic relativity would hypothesize that speakers of a classifier language cannot possess the notion that objects and substances are fundamentally different—to the extent that they can be characterized as ontologically different (Quine, 1969). According to the Quinian hypothesis, infants should have no way of knowing that the word *rabbit* does not refer to just a portion of a whole rabbit. Likewise, nothing can prevent a very young child from assuming that a ~~piece (e.g.,~~ handle~~)~~ of the *cup* he is now holding is also a referent of the word *cup*, as is also the case for *milk*. The only way a child can come to know the fundamental ontological difference between *cup* and *milk* is through observations that his language (English)

consistently distinguishes the former (objects) from the latter (substances): The word ***cup*** is always preceded by "a" or followed by "s," whereas this pattern is almost never observed for ***milk***.

The second, and milder, possibility is that the linguistic difference with respect to systematic marking of count/mass status modifies speakers' relative attention to the perceptual dimensions (e.g., shape, color, material) that are important for determining the status of individuation for entities. For example, Lucy (1992) hypothesized that, because objects are clearly differentiated from substances by the count/mass grammar in English, and because shape is generally the strongest perceptual cue in determining category membership for objects, English speakers should manifest a stronger attention to shape in determining similarity. In contrast, because classifier languages treat all entities as undivided mass consisting of a certain substance, speakers of a classifier language should show a stronger attention to the material of the entity. Speakers of a classifier language might be able to appreciate the distinction between objects and substances; in other words, they might understand that the category membership of objects should be determined on the basis of shape similarity, while also knowing that shape is not relevant for determining the category membership for substance kinds. Nevertheless, language may bias speakers to pay attention to a particular perceptual property in determining whether the given thing is an object or a substance. That is, broadly speaking, we could imagine that people share a universal way of distinguishing objects and substances from each other, but that linguistic differences may also influence how speakers of different languages divide entities in nuanced ways.

Finally, the language universalists would argue for the third possibility, that the way of differentiating objects from substances is universal across all humans and therefore categorization processes are not affected by language (Soja et al., 1991).

Imai and Gentner (1997) tested the above three possibilities by comparing Japanese-reared and English-reared children of three age groups (early 2-year-olds, late 2-year-olds, 4-year-olds) and adults. Imai and Gentner devised a word extension task in which the experimenter introduced a novel word (e.g., ***dax***) in association with an unfamiliar physical entity that the children had never seen before. Participants were presented with a target entity as well as two test items and were asked to judge to which of the two alternative entities the label given to the target entity should be applied. One of the test items was the same as the target with respect to shape but different in material. The other alternative entity was the same as the target with respect to material

composition but different in shape. Children's choice between the same-shape or same-material alternative should tell us which of the two dimensions children use for generalizing the novel label (Figure 1.1).

To minimize the effect of grammatical constraints, Imai and Gentner (1997) used specific wordings. For English speakers, the novel words were introduced in such a way that participants could not know whether the entity is syntactically seen as a count or a mass noun—for example, "Look at this *dax*. Can you point to the tray that also has the *dax* on it?". Because the grammatical structure of Japanese does not reveal the noun's status of individuation, sentences in Japanese naturally did not provide countability information about the target entity—for example, "*Kore* (this) *wa* (Topic-marking particle) *dax desu* (IS). *Dochira* (which) *no* (genitive) *sara* (tray) *ni* (locative particle) *dax ga* (subject-marking particle) *aru* (exist)?".

Imai and Gentner (1997) then set up three different types of physical entities. The first type, the ***complex objects***, were real artifact objects that had fairly complex shapes and distinct functions (see Figure 1.1a). For example, a T-joint pipe made of plastic (target) was presented along with a metal T-joint pipe (shape test) and broken pieces of the target (material test). If the

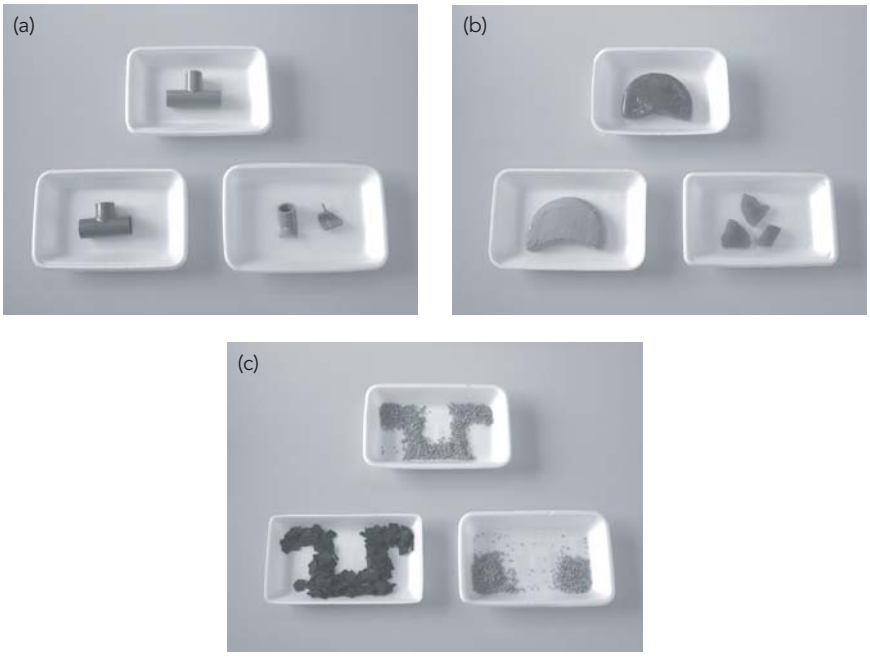

FIGURE 1.1: Sample material sets for a complex object trial (a), a simple object trial (b), and a substance trial (c).

participant pointed to the metal pipe, it was assumed to be an indicator that he or she construed the thing as a countable object. In contrast, if the participant pointed to the plastic pieces, it would indicate that he or she saw the target entity as an uncountable substance. The second type of entity, the ***simple objects,*** had very simple structures with no distinct parts. They were made of a solid substance, such as wax, and were formed into a very simple shape. For example, a kidney-shaped piece of wax (target) was presented together with a kidney-shaped piece of plaster (shape test) and some wax pieces (material test) (see Figure 1.1b). The third type of entity, the ***substances,*** were nonsolid substances, such as sand or hair-setting gel, that were arranged into distinct, interesting shapes when presented. For example, a target of wood chips formed into a U-shape was presented together with tiny leather pieces configured into a U-shape (shape test) and piles of wood chips (material test). Here, Imai and Gentner hypothesized that solid entities with complex and cohesive structures would be more naturally (and perceptually) individuated than entities with simple structures. They also hypothesized that entities with simple structures would be more naturally individuated than nonsolid substances.

Both Japanese and English children and adults clearly showed similar classification styles based on the entities' perceptual appearance. That is, all participants tended to show an object construal and to extend the labels by shape when they engaged in the complex object trials. They showed a substance construal when they engaged in the substance trials. The pattern suggests that even 2-year-old Japanese children, who had no knowledge of the concept of count/mass syntax found in English, could apply different rules for determining identity for complex objects and substances.

However, when English and Japanese speakers' classifications were examined more closely by comparing the behavior of the two language groups within each trial type, there was a marked difference in how English and Japanese speakers construed the simple objects and the substances. For example, in the simple object trials, English speakers treated the simple-shaped discrete entities in the same way as the complex objects and showed a clear object construal bias, whereas Japanese children did not show any systematic tendency in their classification. In fact, Japanese adults tended to see the simple objects as uncountable substances, choosing the material alternative more often than the shape alternative. Similarly, in the substance trials, whereas Japanese speakers almost always generalized novel words based on the material identity, English speakers did not show any specific tendency in classification.

In sum, Imai and Gentner's (1997) results suggested that the ontological distinction between objects and substances is universally shared, refuting the strong version of linguistic relativity (e.g. Quine, 1969). At the same time, they also uncovered noteworthy cross-linguistic differences between the two language groups in a way that was in part consistent with Lucy's (1992) proposal.

C. Developmental Trajectory of Shape Versus Material Bias Across Linguistic and Nonlinguistic Contexts

Are the cross-linguistic differences found in the word extension classification task replicable in a no-word classification task in which people are asked to determine which of two test stimuli is the "same" as the standard? Many studies have reported that children tend to form more adult-like, consistent categories when asked to determine an extension of a novel label (i.e., to find new referents of the label given to a target entity) than when asked to determine the "same" object without using any labels (e.g., Imai et al., 1994; Landau, Smith, & Jones, 1988; Markman & Hutchinson, 1984; Waxman & Gelman, 1986; Waxman & Kosowski, 1990). If that is the case, the language effect would be weakened when people engage in a no-word classification task.

To examine this possibility, Imai and Mazuka (2007) tested Japanese-speaking and English-speaking 4-year-olds and adults, using a no-word classification task. The stimuli and the procedure were the same as in the word extension task used by Imai and Gentner (1997), except that word labeling was not involved. The participants were presented with a target entity and two alternatives and were asked to select which of the alternatives was the same as the standard entity. The English instruction was "Show me what's the same as this," and the Japanese instruction was "***Kore*** (this) ***to*** (with) ***onaji-nano*** (same) ***wa*** (topic-marking particle) ***docchi*** (which) ***desuka*** (IS-question)?"

The results in general indicated that, across the three trial types, Japanese speakers put more weight on the material in determining the referent of the word (material bias), whereas English speakers put more weight on shape (shape bias). Thus, the cross-linguistic difference found in the word extension task (Imai & Gentner, 1997) was replicated in the no-word categorization task.

The detailed analysis revealed that the adults' performance in this no-word categorization task was virtually identical to that observed in the word extension task, as shown in Figure 1.2b (American adults) and Figure 1.2d (Japanese adults). In the simple object trials, for example, adult English speakers and

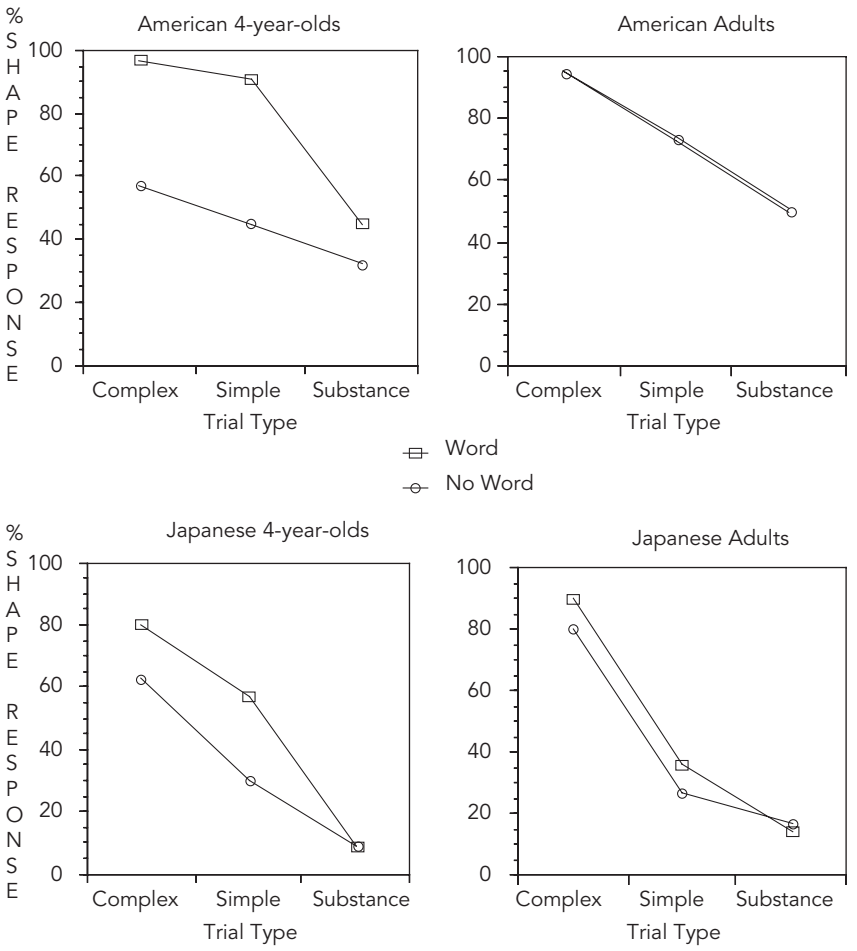

FIGURE 1.2: Subject's classification behavior in the no-word context on word extension (neutral-syntax) tasks and nonlexical classification tasks: American 4-year-olds (top left), American adults (top right), Japanese 4-year-olds (bottom left), and Japanese adults (bottom right).
(Adapted from Imai & Mazuka, 2007.)

adult Japanese speakers showed the opposite classification patterns. In contrast to adults, children's classification styles in the no-word classification task were very different from the styles they showed in the word extension task. This discrepancy between the word extension and no-word classification tasks was particularly large in English-speaking children (see Figure 1.2a). Whereas the English-speaking children in the word extension task showed virtually the same response patterns as the adult English speakers, their performance in the no-word categorization task was at a chance level in all three trial types.

D. Language-Specific Construals of Entities Constrained by Universal Ontology

What can be concluded so far from the results of Imai and Gentner's (1997) and Imai and Mazuka's (2007) studies? First, participants' classification in terms of the ontological distinction between objects and substances is universally shared, regardless of whether the speaker's native language grammatically marks this distinction. However, at the same time, it appears that language-specific syntactical structures can influence the default construal of entities that are located around the boundary of the two ontological kinds. The structure of the English language seems to bias English speakers toward the object construal (i.e., bias to classify perceptually ambiguous entities based on shape), whereas the structure of the Japanese language seems to bias Japanese speakers toward the substance construal (i.e., bias to classify perceptually ambiguous entities based on material). English speakers may develop simple perceptual heuristics that can be instantly applied even when they have very little knowledge about the target entity. Because solidity and boundedness are in general very good indicators for individuation, English speakers may also develop a bias toward construing any solid, bounded entity as an individuated object, even including simple-structured entities that could as well be construed as chunks of rigid substances. Also, because complex shape is another good indicator of individuation (Gentner & Boroditsky, 2001), English speakers may form a strong sensitivity to shape, and this may have led the English speakers in our studies to think that the complex shapes in which the nonsolid substances were configured indicated individuation, even though they could see that those entities were indeed portions of nonindividuated substances.

To what degree Japanese speakers' classification was influenced by language is not so clear, because there are two possible ways of interpreting the results. This is in part because two interpretations are possible concerning the count/mass status of nouns in classifier languages. Some linguists and philosophers (e.g., Chierchia, 1998; Quine, 1973) maintain that all nouns in classifier languages are indeed mass nouns (e.g., the Japanese noun ***ushi*** should be regarded as equivalent to the English word ***cattle***, but not ***ox*** or ***cow***). In this framework, Japanese speakers' classification would be interpreted as a material bias. Alternatively, Japanese speakers' understanding of physical entities could be interpreted as a direct reflection of the entity's perceptual nature, and we could imagine that the classifier markers did not play any important role at all in their classification. With the current data, it is difficult to tease out these

two possibilities. As we describe later, however, the response pattern of English-speaking 4-year-olds in the no-word classification task was more similar to that of Japanese children and adults than to that of English-speaking adults. This suggests that Japanese speakers' classification pattern may be more natural than English speakers' classification pattern; it may be the count/mass grammar that leads English speakers to deviate from the natural partition of the object–substance continuum.

E. Ontological Concepts Shaped by Language

As we have reviewed in section I, developmental researchers have noted that language fosters conceptual development, and this can be considered as support for the Whorfian hypothesis. This was exactly what we found in our study as well.

The research of Imai and Mazuka (2007) revealed an interesting developmental pattern of language-specific biases. English-speaking children's performance was very similar to that of English-speaking adults in the linguistic context when they engaged in the word extension task, but their performance in the no-word classification task was more similar to that of the Japanese children than it was to that of adults in their own language group. In contrast to children, adults within each language group showed virtually identical response patterns in classification behavior across the word extension and the no-word classification contexts. This pattern suggests that children first become sensitive to conceptual/semantic features that are relevant to making language-specific categories in the realm of language, and this sensitivity gradually forms into a language-specific bias that is habitually applied even in situations that do not directly involve language.

What should be highlighted even more is the fact that both English- and Japanese-speaking children showed classification according to the ontological constraints in the context of word extension but not in the no-word context. But what do we mean by saying that children's classification is "ontologically constrained" in word extension? Imai and Mazuka (2007) set up an experiment in which, in contrast to the previous forced-choice experiment, children were allowed to choose as many test items as they wished. In the no-word classification context, children tended to choose both the shape test item and the material test item simultaneously within a single trial. In other words, they simply selected the items that were "the same" either in shape or in material. As a result, the formed category was a chain-like category, "things of the same shape OR of the same material." However, in the word extension context, chil-

dren rarely made this chain-like category, choosing either the shape or the material item, but not both, within a single trial. In other words, children know that a linguistic label does not refer to a chain-like category. They know that if a label refers to an object, then material is not relevant for determining other category members; they also know that if a label refers to a substance, shape is not relevant for determining the sameness of the item to the target.

However, without ***some form*** of the understanding that objects and substances are of fundamentally different existences, children could not have applied different extension principles to a novel noun associated with a novel object or a novel substance (Huntley-Fenner, Carey, & Solimando, 2002; Soja et al., 1991).

We should note, however, that the rudimentary conceptual understanding that objects and substances have different natures does not always lead to formation of categories on the basis of ontological constraints. Things can be categorized in many ways, so there is more than one way of grouping them. For example, we can classify things on the basis of similarity in one particular perceptual dimension such as shape, texture, or color. Alternatively, we can group the same things on the basis of a thematic relation or on the basis of biological and behavioral characteristics shared among members of the ontological or taxonomic kind. Even though children at a certain age might have a rudimentary understanding of the ontological distinction between objects and substances, in the presence of multiple kinds of similarity they might not yet know how adults in their community group things in the world ***by default*** when a special goal or context is not specified. Language is one force that draws children's attention to the kinds of categories that are normally used by adults in their community (Gentner & Namy, 1999; Imai et al., 1994).

F. Culture and Language

As mentioned earlier, the relation between language and culture is a thorny issue, especially when one wishes to separate the two and determine which of them is responsible for the observed difference between two groups. After all, the differences between Japanese speakers and English speakers (Americans) found by Imai and Gentner (1997) might be attributable to culture instead of language. In fact, some cultural psychologists (e.g., Nisbett, 2003; Nisbett et al., 2001) discussed the differences between Americans and Japanese in terms of culture-specific ways of perceiving the world, which were inherited by individuals through the history of the culture. They further claimed that cultural

variations in classification in Imai and Gentner could have been mediated by people's cultural views rather than differences in grammar. So which of the two factors (language vs. culture) is most likely responsible for the differences between Americans and Japanese?

We ~~admit~~ that it is in general extremely difficult to separate the two factors experimentally. However, for this particular case of differences between English and Japanese speakers, the results of a control study by Imai and Mazuka (2007, Experiment 3) favor the interpretation that language is the primary factor in explaining the difference in classification styles between English and Japanese speakers. In this experiment, the stimuli and the procedure were the same as those used in the Imai and Gentner (1997) study of word extension with ambiguous syntax, with one exception: A novel noun was presented either in the count noun or the mass noun syntactic frame. The participants in the count noun condition heard novel nouns in the count noun syntax throughout across the three entity types (complex object trials, simple object trials, and substances trials). Likewise, for those in the mass noun condition, novel nouns were presented in the mass noun syntax for all the trials. The instruction used in the count syntax condition was, "Look! This is *an* X (pointing the target entity). Can you point to *another* X?" The instruction for the mass noun condition was, "Look! This is X. Can you point to *some more* X?"

As shown in Figure 1.3, when novel nouns were presented in the mass noun syntactic frame, the default classification pattern (i.e., the pattern in the ambiguous syntax case in Imai and Gentner's 1997 study) was drastically changed by the syntactic markers. The English-speaking adults' response pattern in the mass noun condition showed a random response in the complex object trials (48%), presumably because the complex objects invite the object construal very strongly and the syntactic information conflicts with this strong default construal. In contrast, they showed a material bias in the simple object trials (85% material response). This suggests that, despite a strong bias toward construing a simple-shaped solid lump of substance as an individuated object, they were fully capable of mapping a novel label to the material of the entity. In the substance trials, again they selected the material alternative highly above chance level (87%).

The response pattern shown by the English-speaking children in the mass noun condition was overall very similar to the adults' pattern, showing a random response pattern in the complex object trials, and a high rate of material responses in the substance trials (59% and 19.6% shape response, respectively).

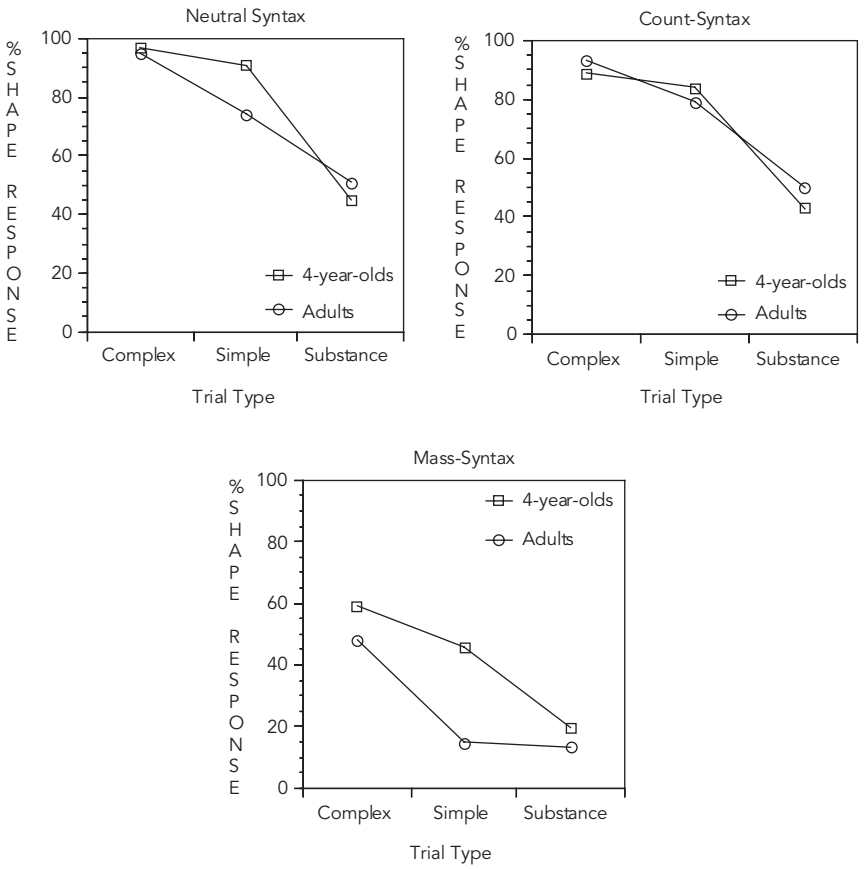

FIGURE 1.3: English speakers' classification behavior in the neutral-syntax condition (top) (from Imai &Gentner, 1997), the count-syntax condition (middle), and the mass-syntax condition (bottom).
(Adapted from Imai &Mazuka, 2007.)

However, in contrast to the adults, the 4-year-olds' performance in the simple object trials was at the chance level (46% shape response).

Recall that in the word extension task in which the ambiguous syntax was used, the English-speaking children's shape response level was very high (91%), in fact almost as high as that for the complex objects (95%). Even though their performance in the simple object trials in the mass noun syntactic frame was at the chance level, their shape-based responses decreased by 45% from the ambiguous syntax case. Therefore, English-speaking 4-year-olds definitely knew that mass noun syntax flags the target entities as substances (see also Subrahmanyan, Landau, & Gelman, 1999, for similar findings). However, because they were so strongly biased toward construing any discrete

entities as individuated objects (Bloom, 1994; Shipley & Shepperson, 1990), it may have been difficult for them to overcome this bias and to construe the entities used in the simple object trials as portions of substances. As in the complex object trials, the mass noun syntax was strongly in conflict with their construal of the entities, and hence their responses fell to chance level.

The response pattern in the count syntax condition was almost identical to the pattern found in the ambiguous syntax word extension task for both age groups, showing a very high rate of shape responses. This is no surprise for the complex and simple object trials, because the rates of shape responses in these two trial types were already at ceiling in the ambiguous syntax case. For the substance trials, however, we had expected to see an increase in shape responding in the count syntax condition, because count syntax indicates that the referred entity is individuated. However, surprisingly, both the children and the adults responded randomly, just as in the ambiguous syntax case.

This suggests that English speakers assumed the novel nouns presented in the ambiguous syntactic frame to be count nouns. Because the count/mass syntax is obligatory in English, perhaps the English speakers in Imai and Gentner's (1997) study did not encode the noun as having a "neutral" syntactic status. Even though the nouns' syntactic status was made ambiguous, the children may have assumed that the nouns were count nouns rather than mass nouns, possibly because the count interpretation is more common for "the/this/that X" (Samuelson & Smith, 1999).

To summarize, the fact that English speakers' object-substance construal reflected their performance in the count noun condition seems to support the idea that language—at least the presence of count/mass grammar in this case—affects English speakers' object-substance construal.

G. Summary

In this section, we reviewed the research of Imai and her colleagues (Imai & Gentner, 1997; Imai & Mazuka, 2007;see also Imai, 2000; Imai & Mazuka, 2003) on object-substance classification tasks, discussing (1) the validity of language relativism versus universalism, (2) the developmental trajectory of the classification process, and (3) the magnitude of cultural versus linguistic explanation of the findings.

First, we underscored the importance of considering universality and diversity simultaneously and in a balanced manner in order to understand the nature of human concepts and cognition. To account for the universality

in the object-substance categorization, it is particularly important to note that the presence of the ontological concept of individuation is not the sole factor that is responsible for the similar classification behavior between Japanese speakers and English speakers. To some degree, the world is structured to form natural clusters, inviting humans to categorize entities according to these natural divisions (e.g., Berlin, 1992; Rosch, 1978). This point strongly resonates with the prototype theory, in which entities that lie at the center of each cluster are considered to be ***better members*** than those that are located near the boundary of an adjacent cluster (Rosch & Mervis, 1975).

In Imai and colleagues' research, the objects used in the complex object trials would be considered better members of the class of ***object kinds*** than those used in the simple object trials, and indeed, participants' classification pattern was greatly affected by how strongly the perceptual nature of the target entity invited humans to place it into a particular category. When the perceptual affordance of a given entity strongly suggested the entity's individuation status, then there was little room for language to affect people's default construal for that entity (cf. Gentner, 1982). When the perceptual affordance of the entity was weak and ambiguous, language influenced the construal, pushing the boundary between object kinds and substance kinds one way or the other (cf. Gentner & Boroditsky, 2001; Malt, 1995; Medin, Lynch, Coley, & Atran, 1997).

Second, we discussed how the influence of language can be seen through the developmental patterns that occur as a language is acquired. Hearing labels for an entity sharpens children's sensitivity to the ontological differences between object kinds and substance kinds and leads them to ontologically constrained categorization.

Third, we maintained that, although it may be attractive to explain the classification process as an effect of culture, overgeneralization of a single explanation needs to be avoided, and careful investigation is needed, especially since the issue is highly relevant to the syntactic structures of a given language. Of course, we do not rule out the possibility that culture plays a role here, over and above linguistic factors. Further research will help us identify to what extent linguistic factors and cultural meaning systems separately or interactively influence human psychological processes.

In sum, to fully understand the issue of diversity and universality in how people understand and construe object kinds and substance kinds, we need to investigate how our universal cognitive disposition and universally possessed

knowledge interact with language-specific linguistic properties as well as culture-specific cognitive biases and, furthermore, how these two factors interact with the way the world is structured and presents itself to humans.

III. CONCEPTUAL RELATIONS AMONG OBJECTS (RESEARCH PROGRAM 2)

In this section, we further address complex relations among language, culture, and cognitive processes by first introducing research findings that emphasize the effect of language (Zhang & Schmitt, 1998) on one hand and the effect of culture (Ji, Zhang, & Nisbett, 2004) on the other hand. We then introduce a series of studies that comprehensively examine the relations among language, culture, and cognitive processes (Saalbach & Imai, 2007, 2011; see also Imai & Saalbach, 2010). Saalbach and Imai's research program examined how speakers of Chinese and German weighed same-classifier, thematic, and taxonomic relations. Finally, we discuss the fact that, in this particular paradigm, the effect of syntactic structure and the effect of cultural practices are observed not conjointly but separately.

A. Two Prominent Conceptual Relations

We organize things (objects and substances) in the world according to various conceptual relations. Conceptual relations are useful tools not only for categorizing and judging similarity of target entities at a given moment but also for making inductive inferences about unseen properties of novel concepts, by means of which people enlarge their scope of knowledge and make predictions about novel items (Medin, 1989; Murphy, 2002). Furthermore, strong conceptual relations seem to be accessed automatically, as has been shown in many studies using the semantic priming method (e.g., Meyer & Schvaneveldt, 1971; Neely, 1977).

Two conceptual relations have been particularly noted as important for linking concepts of individual objects. One is, of course, ***taxonomic*** relations. Taxonomic categories are denoted by nouns and include items of the same kind. They are differentiated into levels of varying specificity (e.g., animal, dog, collie) related by class inclusion (e.g., a collie is a dog, a dog is an animal, a collie is an animal). Numerous studies have shown that both children and adults apply taxonomic relations to organize concepts (e.g., Gelman & Markman, 1986; Markman, 1989; Osherson, Smith, Wilkie, López, & Shafir, 1990; Waxman & Gelman, 1986).

Recently, however, researchers have shown that *thematic* relations are also an integral and important part of the conceptual structure, not only for children (e.g., Imai et al., 1994; Markman, 1989; Smiley & Brown, 1979) but also for adults (e.g., Lin & Murphy, 2001; Wisniewski & Bassok, 1999). Lin and Murphy (2001) suggested that many human concepts include knowledge of nontaxonomic relations, with thematic relations being the most important among them. These authors defined thematic relations as external relations that arise through objects' co-occurring or interacting together in space or time, or objects' being linked by functional or causal relationships (e.g., table and chair, morning and newspaper, scissors and paper).

B. Culture-Specific Preferences for Taxonomic and Thematic Relations

The concept literature reviewed in the previous section suggests that taxonomic and thematic relations are both important organizers of concepts, and it assumes that this holds for all people independent of culture or language. However, the cultural psychology literature has proposed that different cultures show differential preference for either of the two conceptual relations. As discussed earlier, Nisbett and colleagues have argued that, whereas East Asians tend to view the environment as a unified whole and pay a great deal of attention to relations that tie elements into the environment, Westerners tend to focus on individual elements separately from the environment in which the elements are embedded (Masuda & Nisbett, 2001; Nisbett, 2003; Nisbett et al., 2001). Along with this schema, Nisbett and colleagues made a specific prediction that East Asians are predisposed to see a scene or event as a whole and are expected to categorize the world around thematic relations, whereas Westerners, with their focus on properties of individual objects, are expected to categorize the world by taxonomic relations.

Ji et al. (2004) tested this particular hypothesis and further attempted to specify whether this cross-cultural difference could be attributed to differences in language rather than culture. For this purpose, they tested four groups on an odd-one-out categorization task. The four groups were (1) American college students, (2) Chinese college students in mainland China, (3) Chinese students living in the United States who were from mainland China or Taiwan, (4) Chinese students living in the United States who were from Singapore or Hong Kong. The participants were asked to choose two items out of three that were most closely related to each other, and the items could be grouped on the

basis of thematic relations, taxonomic relations, or neither. The American participants were tested only in English. The Chinese groups were tested in Chinese and in English.

Ji et al. (2004) predicted that the Chinese groups, including bilinguals, would be more likely than the native English speakers to endorse holistic judgments (i.e., categorized on the bases of thematic relations) rather than analytic judgments (i.e., categorized on the basis of taxonomic relations), regardless of the language used during the sessions. However, not only the Americans but also the Chinese/English bilinguals from Hong Kong and Singapore made groupings based on taxonomic relations more often than did the mainland Chinese or Taiwanese. These results suggest that both cultural worldview and language interactively play crucial roles in determining the relative weight of taxonomic and thematic relations. But is it that language mediates the effect of culture on categorization processes or that culture mediates the effect of language on categorization processes? Ji and colleagues seemed to put more weight on the effect of culture rather than that of language. However, it is a chicken-and-egg problem. Although one could maintain that the Hong Kong and Singapore Chinese responded more like Americans than did the mainland Chinese because their cultures are more westernized, others could argue that such a pattern was obtained because of their familiarity with English, which had been established as a medium of thought from early on. In other words, it is difficult to disentangle the effect of culture from the effect of language through this kind of reasoning.

C. Do Classifiers Function as Conceptual Organizers?

To further complicate matters, there is another linguistic factor that these authors did not consider. Chinese is a classifier language. As mentioned earlier, classifier languages require a classifier when quantifying entities, whether the entity is an object or a substance. More importantly, classifiers categorize nouns into classes and provide additional semantic information about the nouns that are classified (Senft, 2000).

Unlike the noun lexicon, which is structured hierarchically around taxonomic relations, the system of classification by classifiers is usually organized around semantic features such as animacy, shape, function, size, rigidity, and social importance, which largely cross-cut taxonomic categories (Craig, 1986; Denny, 1986; Downing, 1996; Gomez-Imbert, 1996; Senft, 1996). For example, ***tou*** is a classifier in Chinese for large animals such as cows, elephants, and rhinoceroses. ***Tiao*** is used for objects that are long and curved or flexible,

including both animals and inanimate objects such as roads, jump ropes, snakes, or fish. *Ba* is used for objects with a handle or objects that can be grasped by the hand, such as umbrellas, screwdrivers, brooms, keys, and combs.

Given that a classifier system categorizes the world in a very different way from taxonomic categories, from the Whorfian perspective it is possible that classifier categories affect the conceptual structures of speakers of the language. If this is the case, we expect that speakers of a classifier language and those of a nonclassifier language will behave very differently in almost all cognitive activities, including category formation, similarity judgments, and, most importantly, inductive reasoning.

There is one study in the literature that attempted to assess the classifier effect, asking whether classifiers affect conceptual organization of the speakers. Zhang and Schmitt (1998) had speakers of Chinese and English rate the similarity of pairs of everyday objects. Half of the pairs consisted of objects that share the same classifier in Chinese, and half of the pairs consisted of objects from different classifier categories. They found that Chinese speakers rated the same-classifier pairs (e.g., newspaper and table) as more similar than the native English speakers did, whereas ratings of the different-classifier pairs (e.g., newspaper and tube) did not differ across the two language/culture groups. On the basis of these results, Zhang and Schmitt concluded that classifier categories strongly affect Chinese speakers' conceptual organization.

These results seem to give some support to the Whorfian hypothesis. However, just as it is difficult to determine whether the East Asian versus Western cultural differences in Ji et al.'s (2004) study indicated that the two cultural groups organize their concepts in a fundamentally different fashion, it is difficult to determine from Zhang and Schmitt's (1998) study whether classifier relations are more prominent than thematic relations or taxonomic relations. Zhang and Schmitt's results suggest that the classifier system may indeed provide Chinese speakers with a way of organizing objects that English speakers do not possess. However, even if this is the case, we would like to know the ***magnitude*** of the impact of the classifier system relative to the impact of taxonomic or thematic relations. It would also be good to know whether the classifier effect found by Zhang and Schmitt is extended in tasks of inductive reasoning. If not, claiming that the classifier system adds a new way of organizing concepts might be an overstatement, although it could still be taken as support for a weak form of the Whorfian hypothesis.

D. Examination of the Influence of Culture and Classifiers on Multiple Tasks

In this section, we introduce research by Saalbach and Imai (2007, 2011) that examined whether language (presence/absence of classifier categories) or culture (West vs. East) might affect people's concepts, using a range of cognitive tasks. In contrast to the broad definition of language used by Ji et al. (2004), Saalbach and Imai narrowly defined language and examined whether the presence of a specific grammatical categorization system (i.e., the classifier system) affects people's categorization process, similarity judgment, and inductive reasoning.

With their narrow definition, Saalbach and Imai (2007, 2011) tested the effect of a specific sense of language (i.e., classifier categories) and that of culture (i.e., East vs. West). Their design allowed for a comparison of the magnitude of the effect due to classifier categories (e.g., Zhang & Schmitt, 1998) relative to that of taxonomic or thematic relations. As discussed, one important point in evaluating the linguistic influence or cultural influence might be to compare their reliance on taxonomic, thematic, and classifier effect across East Asians (who are speakers of a classifier language) and Westerners (who are not). If it turns out that East Asians use thematic relations as a basis for core cognitive activities while Westerners use taxonomic relations, but that neither group relies on classifier relations, it can be concluded that it is culture rather than language that is responsible for the group difference. It is also possible to test whether speakers of a classifier language process information differently from speakers of a nonclassfier language by examining to what extent speakers of each language base their judgment on classifier categories.

1. Categorization

Saalbach and Imai (2007) presented Chinese (classifier language) and German (nonclassifier language) participants with a triad of objects, one of which served as the standard and the other two as test items. Participants were asked to determine which of the two test items best matched the target item (e.g., flower). The stimuli included a taxonomic item (e.g., tree), a thematic item (e.g., vase), a classifier item (e.g., cloud), and a control item (e.g., cup). Neither the taxonomic item nor the thematic item belonged to the same classifier class as the target item. The control item was unrelated taxonomically or thematically to the target item and was from a different classifier class. The test items thus included six types of contrasts around the same target item, so that the

four relations were pitted against one another in a pair: (1) classifier (cloud-flower) versus taxonomic (tree–flower), (2) classifier (cloud–flower) versus thematic (vase–flower), (3) classifier (cloud–flower) versus control (cup-flower), (4) taxonomic (tree–flower) versus thematic (vase–flower), (5) taxonomic (tree–flower) versus control (cup–flower), and (6) thematic (vase–flower) versus control (cup–flower).

The results indicated that Chinese speakers did not use classifier categories as the basis for categorization. When the same-classifier item was pitted against the taxonomic or the thematic item, both Chinese and German speakers made categories exclusively on the basis of the taxonomic or the thematic relations. When the same-classifier item was contrasted with the object that was not related to the target object (control), both Chinese and German participants judged the same-classifier item to be the better match to the target. This finding suggests that there is an inherent similarity among objects belonging to the same classifier category. Even when objects do not share any taxonomic or thematic relations, this inherent similarity is detectable even by speakers of a nonclassifier language, and people use it when there is no other kind of similarity to resort to in forming categories. However, even speakers of a classifier language do not use this kind of similarity for categorization over and above thematic relations, when thematic relations are present.

In addition, Saalbach and Imai (2007) did not find any evidence to support the idea that German speakers (Westerners) organize object concepts around taxonomic relations whereas Chinese speakers (East Asians) organize them around thematic relations. Chinese and German speakers equally preferred the thematic match over the taxonomic match. However, this does not preclude the possibility that the classifier system makes an impact on the speakers' cognition in a subtler way, for example, by heightening attention to semantic features underlying classifier categories, something that might be revealed by more sensitive, finer-grained tasks. To test this possibility, similarity judgment and inductive reasoning tasks were next conducted using a rating scale.

2. Similarity Judgments

In the similarity judgment task, Chinese and German speakers were presented with pairs of objects and asked to judge similarity between the two objects on a rating scale from 1 (***very dissimilar***) to 7 (***very similar***). Around the same target object, four pairs were constructed representing taxonomic, thematic, same-classifier, and unrelated (control) relations. The objects were presented in words rather than in pictures.

The overall pattern of rated similarity was very similar across the two language groups. Speakers in both language groups gave the highest ratings for the taxonomic pairs, followed by the thematic pairs and then the classifier pairs. Consistent with the results of the categorization task, both Chinese and German speakers rated the same-classifier pairs as more similar than the control pairs. This result again suggests that even speakers of a nonclassifier language (German) can detect an inherent similarity between objects belonging to the same classifier category. At the same time, however, Chinese speakers' similarity judgments for pairs drawn from the same classifier classes were higher than those of the German speakers, indicating that the inherent similarity residing in classifier categories was magnified for speakers of a classifier language. In addition, Saalbach and Imai (2007) reported some evidence that gave credence to Ji et al.'s (2004) proposal but in a subtler way than they claimed. As stated earlier, when the similarity ratings for the taxonomic and thematic items were directly compared, both Chinese and German speakers gave higher ratings for the taxonomic than for the thematic relations. However, looking at just the thematic items, the Chinese speakers gave higher similarity ratings than German speakers did for the same items. Given that Chinese speakers tended to give higher ratings than German speakers for all items, including the control items, we used the difference between the thematic items and the control items as the dependent measure (Figure 1.4). Even when the base response difference was adjusted in this way, Chinese speakers judged

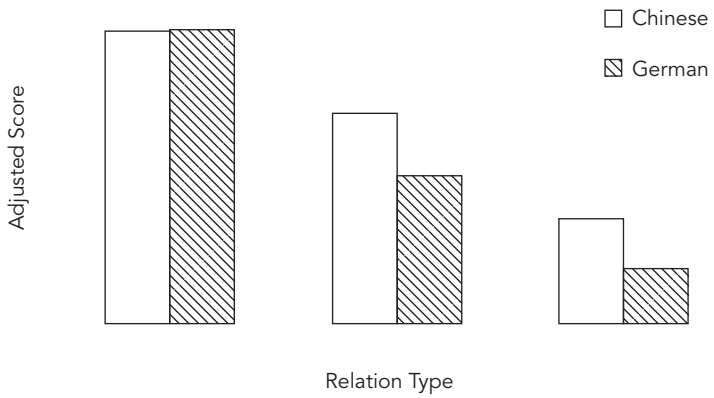

FIGURE 1.4: Adjusted scores for each relation type among Chinese and German speakers in the similarity judgment task in Saalbach and Imai (2007).
The adjusted score was obtained by subtracting the raw score for the control item from each target relation in each set within each cultural group. This manipulation was performed to adjust the baseline differences across the ~~different cultural~~ groups.

two thematically related objects as more similar than German speakers did, supporting Ji et al.'s hypothesis that East Asians would put more weight on thematic relations than Westerners. However, Chinese and German speakers did not differ in their judgment of similarity for the taxonomic pairs. Thus, Ji et al.'s claim was only partially supported.

3. Property Induction-Judgment with a Blank Property

In the property induction task, Chinese and German speakers were presented a pair of objects and asked to rate the likelihood that the two objects share an unknown property; the object pairs were the same as those used in the similarity judgment task. Participants were instructed as follows: "Suppose that property X is an important property for [Object 1]. If [Object 1] has property X, how likely is it that [Object 2] has also property X?" The participants were asked to judge the likelihood on a rating scale of 1 (***not likely at all***) to 7 (***very likely***).

The pattern of the results of this study was strikingly similar to the pattern observed for the similarity judgments (Figure 1.5). Participants in both language groups rated the likelihood in the following descending order: taxonomic, thematic, same-classifier, and control (unrelated) items. The results indicated that both Chinese and German speakers judged it more likely that same-classifier items share an unknown property, X, with the target than that control items do. At the same time, Chinese speakers gave higher likelihood ratings than German speakers for the same-classifier items as well as for the thematic items after adjusting for the difference in the control pairs.

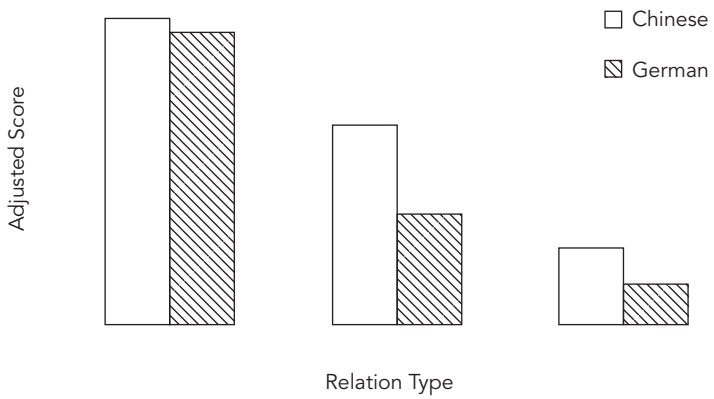

FIGURE 1.5: Adjusted scores for property induction (on the blank property) for each target type in Chinese and German speakers in Saalbach and Imai (2007).

4. Property Induction-Judgment with a Known (Concrete) Property

Saalbach and Imai (2007) further examined whether people utilize classifier relations in property inference even in a context in which they are able to recruit some pieces of concrete background knowledge. Following a previous study comparing taxonomic and thematic relations for the power supporting inductive generalization (Lin & Murphy, 2001), "likelihood of carrying the same bacteria" was used for the concrete property, because most people have some knowledge—but not highly specific scientific knowledge—about bacteria. Participants were asked, "How likely is it that [Object 1] and [Object 2] carry the same bacteria?" and recorded their judgment on a rating scale of 1 (***not likely at all***) to 7 (***very likely***).

This time, neither Chinese nor German speakers rated the same-classifier item as having a higher probability than the control item in carrying the same bacteria (Figure 1.6). The results indicated that, although both Chinese and German participants noted the similarity of underlying classifier categories in the similarity judgment task, neither group utilized this similarity in inductive reasoning. Furthermore, the language-specific classifier effect observed in the inference of a blank property was no longer found.

The results from the two inductive inference tasks suggest that, when making an inductive inference from a completely unknown property, people use similarity as a basis for inductive reasoning. Because classifier relations influence Chinese speakers' construal of similarity, they also influence Chinese speakers' inductive inferences when the speakers cannot access any other

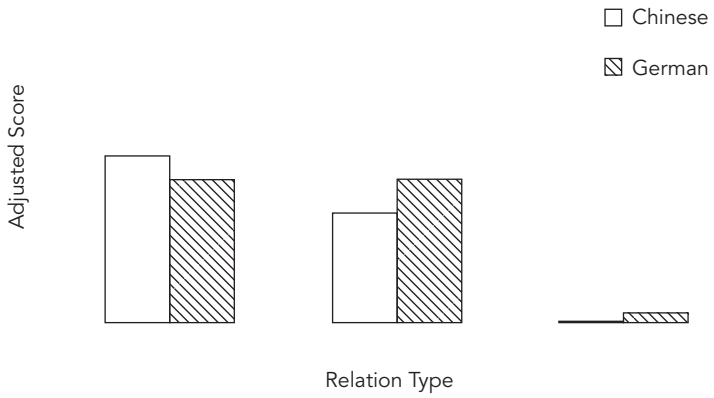

FIGURE 1.6: Adjusted scores for property induction (on the "carrying the same bacteria" question) for each target type in Chinese and German speakers in Saalbach and Imai (2007).

knowledge for inference. However, when Chinese speakers judged the likelihood that two objects carry the same bacteria, they engaged in causal reasoning by utilizing existing knowledge about the conditions in which bacteria are likely to be found. That is, the participants judged that taxonomically related objects were likely to carry the same bacteria, because things of the same kind may provide similar conditions for supporting a certain kind of bacteria (Lin & Murphy, 2001). Likewise, they judged that thematically related objects were likely to carry the same bacteria because the transmission of bacteria depends on external contact among items that co-occur in space and time. In contrast to taxonomic or thematic relations, Chinese as well as German participants judged that the kind of similarity relation underlying classifier category membership (e.g., shape similarity, size, rigidity, functionality) would not heighten the likelihood of the two objects' having the same bacteria.

E. Development of Language-Specific Biases

Imai et al. (2010) further tested Chinese- and German-speaking preschool-age children to see whether the classifier system in the Chinese language influences young children's conceptual structure in nonlexical categorization and inductive generalization of a property.

Twelve item sets, each consisting of four color drawings of familiar objects, were prepared. Each set contained a target item (e.g., carrot), a taxonomic item (e.g., tomato), a shape item (e.g., match), and a thematic item (e.g., rabbit). The shape item belonged to the same classifier category as the target. In the nonlexical categorization task, children were presented with the four items and were asked to choose which of the three test items would best match the target. In the property induction task, they were shown a picture of the target object and were told that the object had a particular novel property (e.g., "Idophome"). They were then shown the three test items and were asked to choose the one that also would have the property.

The results again revealed a complex interplay between the effect of classifiers and task-specific biases that are shared across the two language/culture groups. Here, as in the adult study by Saalbach and Imai (2007), we see some support for the Whorfian hypothesis: Chinese preschoolers used classifier relations as a basis for nonlexical categorization at a higher rate than German preschoolers did. However, this cross-linguistic difference was not observed in the property inference task. There, neither Chinese nor German children relied on classifier relations (i.e., shape similarity) in generalizing a novel property to

other objects. Instead, both Chinese and German 5-year-olds generalized the properties on the basis of taxonomic relations.

In contrast to the group differences with respect to the classifier effect, Germans and Chinese children did not exhibit any difference in preference for taxonomic versus thematic choices, something that would be predicted by the culture-specific cognition hypothesis proposed by Nisbett and colleagues (Ji et al., 2004; Nisbett, 2003; Nisbett et al., 2001). The fact that children relied on taxonomic, thematic, or shape (same-classifier) relations differently across three kinds of categorization contexts suggests that children's categorization behavior strongly depends on the task at hand rather than on a particular general conceptual preference (cf. Waxman & Namy, 1997). In other words, even young children are aware of what kind of conceptual relations should be recruited for a given task and are able to flexibly shift the basis for categorization.

This result—that an influence from the classifier system is found only in the nonlexical categorization task—is consistent with the results from previous research examining classifier influence in adults (Saalbach & Imai, 2007). Like adults, children flexibly shift the basis for categorization according to the task, and the influence of the classifier system is manifested differently across different task contexts. In fact, the cross-linguistic/cultural ***similarity*** between the Chinese and German children in nonlexical categorization and property generalization tasks was striking. Any cognitive bias due to classifiers may be too weak to stand up against the inherent or task-specific biases (e.g., shape bias for label extension, taxonomic bias for property inference) that have been identified across many different language/culture groups.

F. Summary: Language/Culture-Specific Cognitive Processes Versus Task-Specific Processes

The overall pattern of the results reported by Saalbach and Imai (2007, 2011) and by Imai et al. (2010) was strikingly similar across Chinese and German speakers and across adults and children. In the two language/culture groups, taxonomic and thematic relations both proved to be important conceptual relations used by people to organize object concepts. The results also showed that German speakers are sensitive to the similarity which results from the semantic features that underlie classifier categories, but the magnitude of this effect was larger for Chinese speakers, providing support for the Whorfian hypothesis. However, it would be an overstatement, given this effect, to state that Chinese and German speakers ***think differently***, for two reasons. First, the

effect of classifier relations, when an effect was found (in similarity judgments and in induction of a blank property), was much weaker than the effect of taxonomic or thematic relations, even for Chinese speakers. Second, the classifier effect found in the blank property induction task diminished when participants were able to access some background knowledge. A plausible conclusion seems to be that the classifier categorization system does not serve as a major organizer of the conceptual structure, nor does it play a major role in the cognitive process in Chinese speakers. The language-specific classifier effect found among Chinese speakers is perhaps best characterized as a magnified sense of similarity through the habitual use of classifiers in association with the names of objects. This further suggests that, if any evidence for the Whorfian hypothesis is found, it is important to specify the magnitude and scope of the effect within a larger picture of universally prominent tendencies of cognition.

Regarding the issue of taxonomic versus thematic preference across East Asians and Westerners (Ji et al., 2004; Nisbett, 2003), conclusions were similar to those for the classifier effect. Compared with Germans, Chinese participants gave thematic relations higher similarity ratings as well as higher likelihood judgments in inductive inferences of an unknown property, which is consistent with Ji et al.'s findings. However, this culture-specific preference toward taxonomic or thematic relations was not observed in the inductive inference of a concrete property (e.g., sharing the same bacteria). It is important to note that thematic relations are important for Germans (Westerners), just as taxonomic relations are important for Chinese (East Asians). Therefore, even though Chinese participants exhibited a stronger preference for thematic relations in similarity judgments than German participants did, the difference was quantitative rather than qualitative.

Saalbach and Imai's results (Imai et al., 2010; Saalbach & Imai, 2007, 2011) highlight the importance of examining the effect of given language-specific categories (as well as the effect of culture) in a range of cognitive tasks and of systematically comparing the size of that effect ~~with~~ to those of other conceptual relations, because an effect may be observed in one type of cognitive activity but not in others. The fact that the classifier effect was obtained in the inductive reasoning task with a blank property but not in the same task with a concrete property (sharing the same bacteria) suggests that the influence of linguistic categories deeply interacts with task-specific constraints, including the type of knowledge and cognitive processes required for the task and the type of conceptual relations relevant for the task

(e.g., Smith, Shafir, & Osherson, 1993). In addition, the similarity underlying two objects from the same (Chinese) classifier category was detected by German speakers, even though they had no knowledge about Chinese classifiers. This is consistent with the conclusion in section II that perceptual properties inherent in the world should also be considered when thinking about universality and diversity in human cognition and concept structures.

Saalbach and Imai's studies (Imai & Saalbach, 2010; Imai et al., 2010; Saalbach & Imai, 2007, 2011) suggest that when we examine the influence of language or culture, we should always consider how diversity in cognition that arises from either language or culture is constrained by universal cognitive dispositions and prior knowledge. These investigators also demonstrated that the influence of culture and language can be tested separately when we limit the scope of "language" and "culture" and define them clearly, and they further suggested that language and culture can influence people's cognitive processes simultaneously. Therefore, it is necessary to reconsider the traditional approach, which assumes the influence of language and culture to be contrastive and asks ***which*** of the two would be ***the one*** factor that shapes thought.

IV. LEARNING TO LABEL OBJECTS AND ACTIONS (RESEARCH PROGRAM 3)

Until now, we have been discussing how language and culture may influence people's construal of entities and the conceptual relations between objects. In the real world, however, objects are embedded in meaningful contexts. We see things in action, and an action takes place in a scene. People move through space or act on objects, and they talk about action events in language. In talking about events, we refer to ~~objects and~~ actions, the object that acts, the object that is acted upon, and the object in which the action takes place, or relations between objects. Objects are usually codified by nouns, and actions are usually codified by verbs. In this section, we address whether and how language (in this case, the grammatical properties of verbs) and culture affect noun and verb learning in children.

In the lexical development literature, there has long been a debate concerning the relative ease of noun and verb learning. Some researchers argue that the learning of object labels (nouns) is universally privileged, compared with the learning of action labels (verbs), because objects are conceptually more concrete and tangible than actions (e.g., Gentner, 1982). Others argue that the relative ease of learning nouns versus verbs depends on properties of

the input language (see later discussion for details of linguistic properties) (e.g., Gopnik & Choi, 1990; Tardif, 1996). The debate in effect revolves around whether universal conceptual factors are more prominent than language-specific linguistic properties or whether the opposite is true.

In addition to this debate, by referring to the finding that East Asians (Japanese, Chinese, Koreans) are more likely than their Western counterparts to be context sensitive (Masuda & Nisbett, 2001; Nisbett, 2003; Nisbett & Masuda, 2003), cultural psychologists have asked to what extent the context sensitivity of East Asian children influences their noun and verb learning and whether their learning ~~speed~~ is qualitatively different from that of English-reared children.

The universalists predict that nouns are easier to learn than verbs equally for East Asian and Western children, whereas relativists predict that verbs are easier to learn for East Asian children than for Western children. To comprehensively examine this issue, and further to discuss how and to what extent sensitivity to context influences children's word learning, we introduce the research of Imai et al. (2008) on the early language acquisition process.

Imai et al. (2008) compared East Asian children of two language groups—Japanese and Chinese—with American children on a novel noun and verb learning task. Japanese and Chinese were both included because these language groups have very distinct linguistic properties, as described later. The results give some support for the universal noun advantage position, because 3-year-old children of all three language groups easily learned novel object labels but failed to learn novel action labels (verbs). However, a noteworthy difference was found across the three language groups as well. The pattern of results again suggests a complex interplay among universally shared cognitive factors, linguistic factors, and possibly cultural factors, although the influence of culture was not extremely strong and interacted with linguistic ~~properties~~.

A. Relative Ease of Verbs and Nouns

Languages differ in the relative salience of verbs and nouns (Gentner, 1982). In English, for example, nouns tend to appear in salient positions (i.e., the first and last positions in a sentence), whereas verbs are sandwiched between nouns. In contrast, in languages such as Chinese, Korean, or Japanese, verbs are perceptually more prominent than nouns because the subject and the object are often dropped from a sentence in these languages. Some researchers maintain that infants and children learning these languages are likely to hear verbs more

frequently than nouns in their caretakers' speech (e.g., Choi & Gopnik, 1995; Kim, McGregor, & Thompson, 2000; Ogura, 2001; Tardif, 1996).

Would these linguistic (syntactic) differences affect how children learn nouns and verbs? Specifically, do Japanese-, Chinese-, or Korean-reared children learn verbs more easily than nouns, and do they learn verbs more easily than English-speaking children do? As mentioned earlier, the universalists have argued that verb learning should be more difficult than noun learning independent of the language children are learning, because verb meanings, which refer to relations among objects, are inevitably more abstract and complex than noun meanings (Gentner, 1982; Gleitman, 1990; cf. Haryu et al., 2011; Imai et al., 2005; 2006). However, other researchers take a relativist position, arguing that the relative ease of noun and verb learning depends on the linguistic properties of the language the child learns (e.g., Choi & Gopnik, 1995; Tardif, 1996).

B. Culture Versus Language

To make the story even more complicated, cultural psychologists address another research question in terms of the relationship between context sensitivity and verb/noun learning. Members of East Asian cultures in general pay closer and finer attention to relations between objects and context (Masuda & Nisbett, 2001; Nisbett, 2003; Nisbett & Masuda, 2003). Therefore, caretakers in East Asian culture should talk about relations among objects more often than they do about objects. For example, Fernald and Morikawa (1993) reported that, compared with American mothers, Japanese mothers had a greater tendency to refer to the context and relations among toys when playing with their children (see also Miller, Wiley, Fung, & Liang, 1997; Tardif, Gelman, & Xu, 1999; Tardif, Shatz, & Naigles, 1997).

Based on the above findings, Nisbett (2003) addressed the possibility that East Asians' sensitivity to context might influence their noun and verb learning processes. However, how and to what degree it influences them has not been fully hypothesized. In this regard, Imai et al. (2008) thought that comparing children who were learning English, Japanese, and Chinese could be very informative, because these three languages differ from one another along the two dimensions that have been assumed to affect the relative ease of verb learning by children. The first dimension is whether the language allows omission of the subject or object nouns for the verb in a sentence (what is called "argument dropping"). For example, in languages like Chinese or Japanese, both the subject and the object of a verb can be dropped. On observing

someone dropping a wallet, a Japanese speaker might say to him, "*Otoshi* (drop) *mashita* (polite-past)," a sentence in which the subject of the sentence, *anata* (you), and the object, *saifu* (wallet), are both omitted. In English, in contrast, omission of nouns from a sentence is generally not allowed. Researchers tend to assume that this characteristic of argument-dropping languages makes verbs easier to learn, because not only will it make the verb perceptually more salient in a sentence, it will also increase the frequency of verbs over nouns in the input that children hear (Gentner, 1982; Tardif, 1996; *cf.* Li, Bates, & MacWhinney, 1993). This dimension contrasts English on one end with Japanese and Chinese on the other end.

The second dimension is the presence or absence of verbal morphology. For example, in English, "ed" is added to a verb stem to make the past tense. Thus, if an English speaker sees a novel word ending with "ed" (e.g., ***fepped***), he or she would think that it is probably a verb. On this dimension, Chinese contrasts not only with English but also with Japanese. Verbs are inflected in both English and Japanese, but not in Chinese; in other words, nouns and verbs are not morphologically distinguished in Chinese (Erbaugh, 1992). Also, remember that in Chinese and Japanese, the subject and the object of a verb are often dropped, and the verb alone can constitute a sentence. In Japanese, even when a verb is produced without nouns, as in *Mite* (Look), *X-teiru* (X-ing), one can tell that the word *X* is a verb by the "*teiru*" ending, which indicates that the action is progressive. However, in Chinese, when a word is produced on its own (and this can happen in a conversational discourse), it is difficult to tell whether it is a noun or a verb. In other words, one can identify a novel Chinese word as a verb ***only when*** it is embedded in a context. If a Chinese speaker hears a novel word (e.g., ***tampa***) by itself, he or she would not know whether it is a noun or a verb (see Li et al., 1993, for a discussion of how Chinese-speaking adults determine grammatical classes of words and their thematic roles in sentence processing).

C.Comparison of Chinese, Japanese, and English in How Children Map and Extend Novel Nouns and Verbs

Given these syntactic properties of English, Japanese, and Chinese, comparison of children from these three language groups should reveal whether it is linguistic or cultural factors that influence early verb learning. Imai et al. (2006; 2008) tested 3- and 5-year-old children learning Japanese, Mandarin

Chinese, or English as their ambient language. Six sets of video action events served as stimulus materials. Each set consisted of a standard event and two test events. In each standard event, a young woman is seen performing a novel repetitive action with a novel object (e.g., a woman holds a brown plastic drainpipe in her right hand and pushes it outward with a punching motion). The two test events were variants of the standard event. In one of the two test events (Action-Same–Object-Change), the same person did the same action, but the object was replaced by another object that was distinctively different from the standard (e,g., the woman is performing the same movement but with a round metallic timer instead of a drainpipe). In the other test event (Object-Same–Action-Change), the theme object was the same but the action was distinctively different from the action in the standard event (e.g., the woman is holding the same plastic drainpipe in her right hand and tapping it against her left shoulder).

While watching the standard event, a child heard either a novel noun or a novel verb, depending on the condition. The child was then shown the two test videos, and was asked to judge which of the two events the target word should be applied to. Imai et al. (2008) expected that, if children understand that a noun refers to an object and that the particular action in which the object is used is irrelevant to the meaning of the noun, they would select the same-object video when they heard a novel noun. In contrast, if they understand that a verb maps to an action and that the agent and the object of the action event are variables that can be changed across different instances of the event, they would select the same-action event when hearing a novel verb.

The most important question is whether children from different language groups would choose the "correct" video (i.e., the object-same video for the noun condition and the action-same video for the verb condition) at equal rates when learning novel nouns and verbs. If the universal noun advantage view proposed by Gentner (1982) is correct, we may expect that children in all three language groups will perform better in learning new nouns compared with new verbs. On the other hand, if the relative ease of noun and verb learning is determined by distributional properties of the input language (Gopnik & Choi, 1990; Tardif, 1996), we may expect that Japanese- and Chinese-speaking children will do better than English-speaking children in learning new verbs. However, even if we see this second pattern, an alternative interpretation may also be possible. That is, it could be that Chinese and Japanese children learn verbs more easily than American children because they can pay attention to the relation between the objects (the actor and the object in this

context) better than American children, who might tend to focus on the objects per se rather than the relation between them. If this is the case, the verb-learning advantage of Japanese and Chinese children might be attributed to culture rather than language. It is possible to predict an entirely different outcome, however. If morphological simplicity (i.e., the lack of verb suffixes as in Chinese) affects the ease of verb learning (Tardif, 1996), Japanese children's performance might be more similar to that of English-reared children compared with Chinese-reared children. If we see this pattern in the results, we can attribute the group difference to language rather than to culture.

D. Universal Noun Advantage and Language-Specific Delay in Verb Learning

1. Support for the Universal Noun Advantage View

In both age groups (i.e., 3-year-olds and 5-year-olds), children in all three language groups were able to choose the Object-Same–Action-Change event in applying a novel noun, and there was no cross-linguistic or developmental difference. Therefore, 3-year-olds, regardless of the language they are learning, have a clear understanding that nouns refer to objects and that specific action in which the referent object is used are irrelevant to the meaning of the noun.

In contrast to their success in generalizing a novel noun to a different scene including the same object, 3-year-olds failed to choose the Action-Same–Object-Change event when asked to apply a novel verb. Not until they were 5 years old could children reliably extend a novel verb to an event involving the same action but a different object. In this sense, the results suggest that learning a new verb is more difficult than learning a new noun, supporting Gentner's (1982) universal noun advantage view.

2. Object Labeling Bias for Verbs in Chinese Children

With this overall pattern in mind, we should also note that the performance of Japanese-, Chinese-, and English-speaking children was not uniform. In fact, we found intriguing cross-linguistic differences in the pattern of novel ***verb*** learning, and the pattern suggested that it is language rather than culture that affects the difficulty children experience with verb learning.

Whereas English and Japanese 5-year-olds were highly successful in generalizing the newly learned verb to the same action in the face of the object change, Chinese 5-year-olds mapped the novel verb to the same-object event (the one in which the actor was performing a different action), suggesting that

they interpreted the novel word as an object name even if the word was unambiguously presented as a verb.

Thus far, the results suggest that Chinese children as old as 5 years of age could not apply newly taught verbs to the same action when the object was changed. Why was verb generalization so difficult for Chinese children? It could be because the lack of morphological distinction between nouns and verbs made it difficult for Chinese children to map a novel word to the action component of the event. At the same time, there must be conditions under which Chinese preschoolers, especially 5-year-olds, can extend novel verbs to the action in the action-same condition. But what kind of cue do they need in addition to linguistic cues? Imai et al. (2008) suspected that the difficulty in identifying a word's grammatical form class solely from word forms might have led Chinese children to rely heavily on contextual cues that reside outside of language.

3. Sensitivity to Contextual Cues in Chinese Children

One property of the experimental stimuli may have given Chinese children a cue that the object was what should be attended to in the event. The standard video clips were crafted in such a way that the actor holds the object for about half a second before the action starts. This manipulation was done to make sure that children see the object clearly. The object was not unnaturally highlighted in the original stimuli, and it did not affect Japanese- or English- speaking children. However, if Chinese children were exceptionally sensitive to situational cues because cues residing in language are harder to access, this first segment of the video might have led Chinese children to think that the object was topicalized in some way.

To test this possibility, Imai et al. (2008) removed the segment of the video clip in which the actor was holding the object. In the new video, the object is already in motion at the very start of the event presentation. This manipulation indeed brought about a drastic change in Chinese children's performance in the verb learning task. Their performance was now equivalent to the level of performance by Japanese- or English-speaking children.

Importantly, when Japanese- and English-speaking children were tested again with these videos, their performance was not affected by the manipulation. Further, Chinese children were tested again on the noun condition using the revised stimuli, and the results confirmed that they had no problem in applying a noun to the same object test. Therefore, it was not the case that Chinese children mapped the novel word simply to the most salient component

of the event, whether it was a noun or a verb. They were able to extend a novel verb to the same action only when the action was maximally salient, but even under this condition (i.e., when the action was more salient than the object), they had no problem in mapping a novel noun to the object.

Taken together, the results show that Chinese 5-year-olds ***can*** extend novel verbs to the same action with a different object, but they need support from contextual or perceptual cues. When contextual cues are in conflict with linguistic cues, it appears that Chinese preschoolers rely more heavily on the former than on the latter, unlike Japanese- or English-speaking children. It is likely that the lack of obvious morphological distinction between nouns and verbs leads Chinese children to be more attentive to objects and that they require stronger contextual cues in order to modify this object bias.

E. Summary

To summarize, the research program presented in this section supported the universalist position at a global level, but again, this did not mean that there was no influence of language or culture. On the contrary, there was a marked difference across Chinese-, Japanese-, and English-speaking children in the degree of difficulty they experienced and in the cues they used in learning novel verbs. Importantly, even though there was an influence of language here, it was not the pattern predicted by Tardif (1996), who emphasized the distributional characteristics of the Chinese (as well as Japanese) language.

The results of Imai et al.'s 2008 study provide important insights regarding universality and diversity of cognition, as well as the relation between culture and language in explaining diversity across different language/cultural groups. First, just as in the cases discussed in sections II and III, the results suggest both universality and diversity. Early word learning takes place within a dynamic interaction among children's universal cognitive disposition, the distributional and syntactic properties of the language they are learning, and the nature of the concepts (e.g., degree of abstractness, complexity of meaning, perceptual accessibility) denoted by the words they are learning. In this interaction, the relative dominance among these factors seems to be hierarchically ordered. Based on the pattern of results in the word learning literature, it is probable that conceptual factors take precedence over linguistic factors. It has been repeatedly observed that, across different languages, children learn labels of objects more readily and more easily than they do labels of actions, and they generalize nouns more willingly than verbs. Linguistic factors, either

structural or distributional, also do affect word learning, but not to the degree that they can override conceptual constraints.

It is difficult to determine ***a priori*** what linguistic properties affect verb learning and how they do so. For example, researchers have long assumed that the existence of argument dropping would make a language advantageous for verb learning because it makes verbs perceptually more salient and more frequent in the ambient language (e.g., Gentner, 1982; Tardif, 1996). However, the fact that English-speaking and Japanese-speaking children showed similar performance whereas Chinese children behaved differently in learning novel verbs suggests that frequency and perceptual saliency of verbs alone may not be the dominant factor in determining the ease of verb learning. A lack of morphology that clearly distinguishes verbs from nouns has also been assumed to reduce the burden for children in learning verbs (Gentner, 1982; Tardif, 1996). However, this was clearly not the case, because, under a default situation in which no additional contextual scaffolding was provided, it was Chinese children who experienced more difficulty in verb extension compared with their English- or Japanese-speaking age-mates.

The cultural framework advocated by Nisbett and colleagues (e.g., Nisbett, 2003)—that East Asians are relation oriented and Westerners are object oriented—seems not to extend to the verb and noun learning process, at least superficially. However, caution is necessary in interpreting this result, because Chinese children's high sensitivity to the contextual cue (i.e., the segment in which the actor holds the object before starting the action) is consistent with the prediction by cultural psychologists (e.g., Nisbett, 2003; Nisbett & Masuda, 2003; Norenzayan, Choi, & Peng, 2007). The question is why this was seen only in Chinese but not in Japanese children.

We can only speculate on the reason Chinese children were so sensitive to contextual cues, even to the extent that linguistic cues (word-order cues and postverbal particles) that were apparent to Chinese-speaking adults were bluntly overridden. To identify the grammatical class of each word in the sentence and assign a thematic role to it, Chinese speakers have to coordinate semantic, syntactic, semimorphological grammatical cues such as aspect markers, object markers, and passive markers in "a complex system of mutual constraints" (Li et al., 1993, p. 190). This linguistic property may lead Chinese children to rely more on contextual cues residing outside of language than on linguistic cues in novel word learning.

This sensitivity to contextual cues could well be shared by Japanese children. However, because linguistic cues are salient in Japanese, these children

may not need to pay attention to this subtle contextual cue in this particular task. In any case, the difference in sensitivity to the contextual cue in Imai et al.'s (2008) research indicates the possibility that the influences of language (i.e., the structural and distributional properties of a language) interact with a culture-specific attentional bias and suggests a complex interaction among cognitive, linguistic, and cultural factors.

V. LANGUAGE-SPECIFIC LEXICALIZATION PATTERNS, CULTURE, AND ATTENTION TO BACKGROUND (RESEARCH PROGRAM 4)

In section IV, we discussed how grammatical aspects of language, especially argument dropping and morphological simplicity of verbs, interacted with universally shared conceptual factors in noun and verb learning in children. In this section, we examine how another aspect of language—which semantic information is likely to be coded in words—affects perception and attention of motion events. In particular, we discuss (1) how universally shared attention to motion scenes changes into language-specific ways of packaging information when learning novel verbs and (2) how language- and cultural- specific ways of codifying events independently or interactively influence attention to motion events in nonverbal contexts.

A. Differences in How Languages Codify Action Events

The ways in which different languages codify actions are very diverse, perhaps even more diverse than the ways in which they codify objects (Gentner, 1982; Talmy, 1986). For example, Germanic languages, including English and German, tend to encode (lexicalize) the ***manner*** of the action in the meaning of a verb (e.g., limp, swagger, march), while expressing the ***path*** of the motion (e.g., in, out, up, down) in a prepositional phrase (preposition + noun). Romance languages such as French, Spanish, and Italian tend to include the ***path*** information in the main verb (e.g., ***entró***, "enter"; ***salió***, "move out"; ***pasó***, "move through"). Here, the manner of the action is optionally encoded outside the verb (usually by an adverb), and this information is often left out. For example, in Spanish, the English expression, "The bottle floated into the cave" is codified as "***La*** (the) ***botella*** (bottle) ***entró*** (MOVED-IN) ***a*** (to) ***la*** (the) ***cuvea*** (cave) ***flotando*** (floating)."

Some other languages, such as Japanese and Korean, encode the ***ground*** information—the property of the background in which the action takes

place—in the meaning of some verbs. For example, Japanese encodes the spatial configuration of the ground being traversed: ***Wataru***, "go across," implies that someone crosses a flat barrier (such as a road or railway track) that comes between two points, whereas ***touru***, "move through," implies crossing a place that is continuous from the starting point and the end point of the motion (Muehleisen & Imai, 1997). So, when English speakers would simply say, "She went across the railroad track (or the tennis court)," Japanese speakers would use two different verbs in describing the two situations: "***Kanojo*** (she) ***wa*** (topic-marking particle) ***senro*** (railroad track) ***wo*** (object-marking particle) ***watat-ta*** (go across-Past)" and "***Kanojo*** (she) ***wa*** (topic-marking particle) ***tenisu kooto*** (tennis court) ***wo*** (object-marking particle) ***toot-te*** (moving through) ***it-ta*** (go-Past)."

B. Language-Specific Lexicalization Patterns and How People Encode Aspects of Action Events When Speaking

Would the differences in the lexicalization of action events lead to differences in how people selectively codify an action event in language? Previous research demonstrates that that is indeed the case. For example, when describing short motion event clips (e.g., a boy crawling up a low hill, a girl jumping into a pool), English speakers produced 18 times more manner verbs than path verbs (Naigles, Eisenberg, Kako, Highter, & McGraw, 1998). A recent study by Maguire et al. (2010) presented English-, Japanese-, and Spanish-speaking children with a video clip of a starfish moving along a particular path in a particular manner and labeled the action in the children's own language. The children were then shown two variants of the original clip—one showing the same starfish moving along the same path but in a different manner, and the other showing the starfish moving in the same manner but on a different path—and were asked to which video the verb should be applied. Before age 3, children of all three language groups mapped the verb to the path, generalizing the newly taught verb to the same-path event. By age 3 and beyond, however, they manifested language-specific patterns in interpreting the meaning of novel verbs; that is, English-speaking children were more likely than Spanish- and Japanese-speaking children to interpret the novel verb as expressing the manner rather than the path of the motion.

Perhaps infants initially and universally extract the same information from the events that they witness and map a label to it. Here, they seemed to naturally pay more attention to the ***path*** of motion rather than the ***manner***

and to think that a novel word codified path, independent of the lexicalization pattern of the language they were learning. However, once children are exposed to a particular language for some time, they start to attend differentially to the semantic components of events that are highlighted in their language.

C. Attention to Action Events: Universally Shared Event Components and Emergence of Language-Specific Attention

From the Whorfian perspective, it is extremely interesting to ask whether the differences in the lexicalization patterns just discussed lead speakers of English and speakers of Japanese to perceive action/motion events differently. More specifically, would the differential attention to the components of action events when using language lead to differential attention to an action scene, even when language is not invoked? If the answer is yes, when and how does this phenomenon start?

To address these questions, Göksun et al. (2011) asked whether and how Japanese- and English-reared infants ***perceive*** figures (actors) and grounds (backgrounds) in events, and how this perception might be modified when children start learning their native language, using a novelty-detection preferential looking paradigm. In each language group, 14- and 19-month-olds were familiarized with a single motion event in which an actor was seen moving across a particular field (e.g., crossing a tennis court). In the test, they were simultaneously shown the original scene and a new scene, in which either the actor or the background through which the actor moved was changed. If infants are able to detect a change in figures or grounds in events, they should prefer to watch the ***novel*** figure or ground, showing longer looking time for the changed scene compared with the original scene with which they have become familiar.

The results indicated that 14-month-olds in both the English and Japanese groups noticed changes in figures and grounds in dynamic events, looking longer at the novel (changed) scene than at the scene to which they had been familiarized during the training session. In other words, infants of this age were sensitive to the categorical ground distinctions for ***crossing*** action (e.g., crossing a tennis court vs. crossing a railroad track) in dynamic events. However, by 19 months, this early sensitivity to categorical ground distinctions was lost for children reared in the English environment, whereas children reared in the Japanese environment preserved these distinctions, suggesting that the process of learning language shifts the categorical boundaries the infants originally possessed before language learning. These results

suggest that infants originally parse nonlinguistic dynamic events into the various nonlinguistic event components that are codified across different languages of the world and attend to all of them regardless of their native language. Then, as children learn how these event components are lexicalized in their native language, they appear to focus on certain semantic distinctions over others, and, ~~thus influenced by the ambient language, they~~ lose the finely tuned attention they originally possessed.

These findings may be thought of as analogous to the restructuring of phonological categories found in younger infants: Infants start out with the universal phonological categories, but by their first birthday, they stop paying attention to fine phonological details that their native language does not distinguish (e.g., Eimas, Miller, & Jusczyk, 1987; Kuhl, Andruski, Chistovich, Chistovich, Kozhevnikova, & Ryskina, 1997; Werker & Tees, 1984). There might be a broad set of foundational components in events that will later be collapsed by attending to only the subset that is coded in one's native language. As children learn their native language, they might semantically reorganize their prelinguistic constructs, either by dividing the category or by creating a broader category (for details of this argument, see Göksun, Hirsh-Pasek, & Golinkoff, 2010; see also Hespos & Spelke, 2007).

D. Alternative Interpretation: Influence From Culture

Here again, however, an alternative interpretation could be proposed from cultural psychology. People often have difficulty detecting obvious changes in a scene when two pictures are presented sequentially (change blindness) (Simons & Levine, 1997); nevertheless, cross-cultural differences in sensitivity to changes in scenes have been reported (Chua, Boland, & Nisbett, 2005; Masuda & Nisbett, 2001, 2006).

When Masuda and Nisbett (2001) presented an underwater scene to American and Japanese adults, the Japanese speakers not only expressed more relationships between the focal figure (e.g., a fish) and the background but also were more likely to describe the background and to describe it in greater detail. In another study, using the change blindness paradigm (i.e., failure to detect the changes in a scene), Masuda and Nisbett (2006) displayed two animated scenes (e.g., a farm) that differed in small details. American adults detected changes in the focal objects, but Japanese adults noticed changes in the background.

Therefore, it is possible that the loss of sensitivity to ground change in 19-month-old English-speaking children could be explained in light of American children's development of a culture-specific mode of event construal. In other

words, decreased sensitivity to the ground change could have arisen in the course of developing attention only to focal objects. With the current sets of evidence, we cannot disambiguate these two interpretations. However, it is also possible that the influence of culture and language is closely coupled, in which case it would not be feasible to try to separate the two, especially when we broaden the definition of "language" and the scope of what we consider to be its influence. As mentioned earlier, Masuda and Nisbett (2001) found that American adults (English speakers) and Japanese adults described an event differently: English speakers tended to talk about the focal objects without mentioning the background in the scene, whereas Japanese adults mentioned the background information or how the focal objects were situated in the background. This issue is explored further in the concluding section of this chapter (section VI).

VI. THEORETICAL IMPLICATIONS AND FUTURE DIRECTIONS FOR RESEARCH ON UNIVERSALITY AND CULTURAL DIVERSITY

A. Summary and Theoretical Implications: Relation Between Language, Culture, and Thought

We have reviewed research investigating universality and diversity (language or culture specificity) of cognition, focusing on four domains: (1) how we construe entities and classify them as objects or substances; (2) how we utilize and weigh three types of conceptual relations—taxonomic relations, thematic relations, and classifier relations—when engaging in cognitive tasks; (3) how we map objects and actions onto nouns and verbs and how we generalize the meanings of novel nouns and verbs; and (4) how we talk about action events and how language-specific lexicalization patterns are related to attention to the objects and the background of action scenes. In all four series of research programs, these questions were addressed not only in light of cross-linguistic comparison but also from a developmental perspective.

The four series of programs converged onto the conclusion that a simple pro-Whorfian versus anti-Whorfian (or a language vs. culture) dichotomy is inadequate. A complex interplay among various factors—including universal cognitive constraints, perceptual affordance provided from the world, task-specific constraints, language-specific biases, and culture-specific cognitive styles—must be considered in order to account for people's behavior in a given cognitive task. This provides important implications for the field of language and thought, as well as for the field of cultural psychology.

In the traditional discussions of the Whorfian hypothesis, demonstration of a cross-linguistic difference between a language with a certain lexical or grammatical categorization system and one without it ***in any task***, be it similarity judgments, categorization, memory, or inductive reasoning, has been taken as evidence for the hypothesis. Likewise, the finding of a cross-cultural difference that is consistent with a hypothesis about cultural influence in a particular task has been taken as evidence for the hypothesis. However, in most cases, the scope of the effect within a global picture of cognition has not been explicitly specified. The results of the four series of studies reviewed in this chapter all suggest that the influence of linguistic categories (or culture) deeply interacts with universally shared cognitive or perceptual dispositions and task-specific cognitive constraints and that language and culture may also interact with one another. This in turn highlights the importance of examining the influence of language (or culture)—not in light of ***whether*** there is an influence but ***how large and meaningful*** the influence is within a broad range of cognitive processes (Imai & Saalbach, 2010; Imai et al., 2010; Saalbach & Imai, 2007, 2011).

In fact, in all of the four domains, the behavior of both adults and children was strikingly similar at a global level but diverged at a finer level. In the domain of object–substance distinction, both English- and Japanese-speaking children appreciated the ontological distinction between object kinds and substance kinds and generalized a novel label according to the appropriate ontological constraints (i.e., objects by shape, substances by material). But they differed in the object–substance construal of perceptually ambiguous entities (such as a kidney-shaped piece of paraffin) that could be construed as either an object or a substance. When the influence of the classifier system was examined, speakers (both children and adults) of a classifier language (Chinese) and those of a nonclassifier language (German) were very similar in that the relative order of preference for taxonomic, thematic, and classifier relations was the same across categorization, similarity judgments, and property inference tasks. Yet, in the similarity judgment task, Chinese speakers showed stronger sensitivity than German speakers to the same-classifier relation. In inferring the meaning of a novel noun and novel verb associated with an action event, Japanese-, Chinese- and English-reared children all experienced difficulty in extending verbs compared with nouns, in spite of large differences across the three languages with respect to availability of verbal morphology and frequency of verb use in the discourse. Yet, these children differed in what cues they needed in order to infer the meaning of novel verbs. In perceiving and verbalizing motion events, young children's initial verb meanings were greatly similar across languages that

lexicalize event components very differently. Infants raised in both Japanese and English environments were originally sensitive to the background (as well as the actor) of motion events, whether or not their ambient language encoded such components. But their attention patterns diverged as a result of assimilating to the dominant lexicalization pattern in their mother tongue (or to the culture-specific mode of attending to the world).

These findings indicate that people (both children and adults) share universal conceptual structures and basic cognitive functions that are likely to have arisen from the interaction between factors residing out in the world (e.g., perceptual similarities that the world presents to all humans [Rosch, 1978]) and factors residing within humans (e.g., cognitive biases that hold stable across different linguistic and cultural experiences). However, this does not mean that there is no room for language or culture to modulate cognition and conceptual structures. Language and culture highlight certain aspects of the world or give us bases for categorization when there are no perceptible divisions (as is the case with spatial relations). More importantly, the relation between language (or culture) and thought is not unidirectional; linguistic categories reflect universally perceived commonalities in the world, but at the same time they modify universally perceived similarities (see Imai & Mazuka, 2003; 2007; see also Malt, 1995, for a relevant discussion).

The four series of studies reviewed in this chapter shed light on how and when we start to see divergence in concepts and cognition in the course of development. Children start out with fine-grained attention to conceptual distinctions but become sensitive to language-specific or culture-specific conceptual or perceptual divisions surprisingly early, although the specific timing may vary across different conceptual domains. In all of the four conceptual domains reviewed, children manifested sensitivity to language/culture-specific patterns at 3 years of age or earlier. English-speaking children started to exhibit the object-construal bias for simple-shaped solid substances as early as 24 months. They also showed dampened attention to the background (possibly due to increased attention to the actor or the figure object) at 19 months.

B. Culture and Language Revisited for Understanding the Nature of Human Concepts and Cognitive Processes

The four series of studies presented in this chapter dealt with specific linguistic categories (count/mass grammar, classifier grammar) or structural properties (e.g., argument dropping vs. compulsory arguments) that function at a

local level. In this narrowly (but hence clearly) defined scope of language functions, we have contrasted the influence of language with that of culture and asked which of them should be more prominent, with the assumption that the two are cleanly separable.

However, we acknowledge that language cannot be regarded as more than just a system of words and rules; it can be broadly defined as a framework for activities in a given language community (Chiu et al., 2007). In fact, language is a medium through which people in a speech community construct what researchers variously call "narratives" (Bruner, 1990; Kashima, Peters, & Whelan, 2008), "meaning systems" (Geertz, 1973; Shweder, 1991), "shared representations" (Latané, 1996; Sperber, 1996), "social reality" (Bruner, 1957), "group norms" (Sherif, 1936), "cultural worldviews" (Nisbett, 2003; Nisbett & Masuda, 2003; Nisbett et al., 2001), "self-construals" (Markus & Kitayama, 1991), and "domain-general interpretive concepts" (Kashima, 2009). In the following sections, we explore how culture and language (as a whole rather than specific aspects or functions) mutually depend on one another and conjointly affect cognition.

1. Cultural World View May Affect Language Use and Discourse Construction

As discussed earlier, Masuda and Nisbett (2001) reported that Americans and Japanese described ocean scenes differently, in ways consistent with what was predicted by the culture-specific cognition (i.e., attention) hypothesis. Along the same line, Maass, Karasawa, Politi, and Suga (2006) argued that Eastern and Western cultural differences are reflected in language use. Adjectives describe properties or traits of objects. Verb phrases, in contrast, "provide greater information about the context and/or the relationship between subject and object" (p. 735). Westerners tend to talk about ***what individuals are like***, describing individuals' traits. As a consequence, they tend to use adjectives more frequently than verbs. Members of East Asian cultures prefer to talk about ***what people do***, reflecting their concern for relations between people, or between people and the world, which leads to greater use of verbs.

Because of their holistic worldview, East Asians may also tend to focus on vocal tone rather than the content of utterances. For example, using the Stroop interference task, Ishii and her colleagues (Ishii & Kitayama, 2002; Ishii, Reyes, & Kitayama, 2003; Kitayama & Ishii, 2002) asked Japanese and English speakers to focus on either vocal tone (context) or meaning (content) of emotional words. Overall, the results indicated that when the vocal tone of an utterance

was incongruent with its verbal content (e.g., when positive words such as *happy* were uttered with a negative intonation), Japanese speakers had greater difficulty ignoring the vocal tone than did English speakers, and English speakers had more difficulty ignoring the verbal content.

2. Mutual Dependence of Culture and Language

These studies suggest that culture and language are deeply related, especially when we define language broadly as a medium for communicating and for constructing shared understanding, as sociocultural psychologists do. Sociocultural psychologists tend to see culture as the cause and language use as the consequence. However, discourse style is definitely within the realm of language, and acquisition of language must include acquisition of the culturally appropriate discourse style or mode of communication (Chiu et al., 2007). From a Whorfian perspective, one could argue that acquisition of a language-specific communication style shapes children's attention to the elements of scenes in culture-specific ways.

Furthermore, as we have discussed, the cause and consequence might not be unidirectional: Culture and language may constitute an inseparable body and influence mental processes conjointly. For example, in a study that targeted 29 languages, Kashima and Kashima (1998) investigated the relationships between the level of individualism in a language community and the pragmatic leniency of the pronoun drop. They found a negative correlation between these variables: The more a language community values individualism, the less it allows the omission of pronouns, even when the pronouns can be inferred. The researchers speculated that, because pronouns function as identifiers of agents in the discourse, the strict use of pronouns in a given language forces speakers to differentiate themselves from others, which in turn results in individualistic thought in the society. But it is also possible to speculate that the reverse is true, that individualistic values lead members of a language community to become pragmatically less lenient regarding pronoun drops.

Mutual dependence between culture and language may also be seen in the use of honorific systems. Relatively speaking, East Asian languages such as Korean, Japanese, and Chinese are more likely than English to use a variety of honorific forms in vocabulary, syntactic structures, and discourse structures. For example, when asked to convey a message, Koreans were more likely than Americans to change their communication style according to the conversation partner's social status, whereas Americans were more likely than Koreans to

change their communication style according to type of information, such as positive versus negative messages or easy versus difficult requests (Ambady, Koo, Lee, & Rosenthal, 1996; Holtgraves & Yang, 1992; the same issue is tested by Miyamoto, Nisbett, & Masuda, 2006). Perhaps such advanced systems of honorific expressions in the vocabulary and pragmatics of a given language conjointly constitute the hierarchy-oriented meaning systems shared by people in East Asian cultures. That is, East Asians institutionalize a complex list of honorific rules because of their cultural worldview, but this worldview is also facilitated and maintained by the institutionalized honorific rules of their languages.

Considering all of these issues together, it might not be highly productive to try to contrast the magnitude of language effect versus cultural effect. To advance our scientific understanding of the human mind, it might be more worthwhile to postulate that language (in its broader sense) and culture are mutually dependent on each other and that together they influence human mental processes.

That said, we are not arguing that language should always be treated conjointly with culture and investigated at a global level. In some cases, it is possible to separate the influence of culture and language, as we have shown in the review of our research, and this provides useful insights into how language and culture are conjointly and separately related to thought.

VII. CONCLUSION

In conclusion, what is most needed in the field is communication between the disciplines of cognitive psychology and cultural psychology. On the one hand, cognitive psychologists or psycholinguists rarely consider the influence of culture when they find an effect of "language" in a linguistic category, or when the effect could be closely or inseparably coupled with culture. On the other hand, sociocultural psychologists often use the term ***language*** (and also ***culture***) vaguely, making it difficult to pin down whether it is really language that is responsible for the differences between groups. Worse still, the two groups of researchers often do not realize that they are using different senses of the word ***language***. It is important to investigate the relation between language and cognition at different levels, but with clear specification of what is meant by "language" and whether language is separable from culture in the particular investigation at hand. Researchers should also specify the scope of the influence of language or culture, or both, before generalizing the effect they have found with a particular task in a particular domain to either language or

culture. Lastly, we should acknowledge that human cognition is not simply universal or simply diverse. Future research needs to specify how cognitive diversity is constrained by language, culture, universal biases within humans, and natural clusterings within the world, and how these factors interact with one another.

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