ORIGINAL RESEARCH ARTICLE
published: 08 December 2010
doi: 10.3389/fpsyg.2010.00194

Are Chinese and German children taxonomic, thematic, or shape biased? Influence of classifiers and cultural contexts

Mutsumi Imai[1]*, Henrik Saalbach[2] and Elsbeth Stern[2]

[1] *Keio University at Shonan-Fujisawa, Fujisawa, Japan*
[2] *Eidgenössische Technische Hochschule Zurich, Zurich, Switzerland*

Edited by:
Debi Roberson, University of Essex, UK

Reviewed by:
Joseph A. Vandello, University of South Florida, USA
Panos Athanasopoulos, Bangor University, UK

****Correspondence:***
Mutsumi Imai, Keio University at Shonan-Fujisawa, 5322 Endo, Fujisawa, Kanagawa 252-8520, Japan.
e-mail: imai@sfc.keio.ac.jp

This paper explores the effect of classifiers on young children's conceptual structures. For this purpose we studied Mandarin Chinese- and German-speaking 3- and 5-year-olds on non-lexical classification, novel-noun label extension, and inductive inference of novel properties. Some effect of the classifier system was found in Chinese children, but this effect was observed only in a non-lexical categorization task. In the label extension and property generalization tasks, children of the two language groups show strikingly similar behavior. The implications of the results for theories of the relation between language and thought as well as cultural influence on thought are discussed.

Keywords: linguistic relativity, cultural psychology, cognitive development, categorization, word learning, inductive reasoning, classifiers

INTRODUCTION

Language classifies the world in various ways. For example, a count-mass grammar system divides all entities – including abstract concepts (e.g., *ideas*, *evidence*) – into two grammatical categories with respect to countability. The categories of a gender grammar system classify nouns into a small number (typically two or three but sometimes more) of gender categories (e.g., masculine, feminine, neutral), regardless of whether the entity has biological sex. Likewise, a numeral classifier grammar system categorizes nouns into different grammatical categories, but unlike the count/mass or gender grammar systems, there are usually over hundred categories.

There are two major functions of numeral classifiers. First, classifiers provide a unit of quantification, like measure terms in English. However, while measure terms are required only for quantifying mass nouns (e.g., a *glass of* water) in English, numeral classifiers need to be applied to all nouns when quantifying them, including clearly individuated objects such as cars, computers, animals, and humans (e.g., *yi* [one] *zhang* [CLASSIFIER] *zhuozi* [table] for Chinese). Second, classifiers divide the set of nouns into disjunctive semantic classes (e.g., Craig, 1986; Denny, 1986, Downing, 1996; Aikhenvald, 2000; Senft, 2000).

However, semantics of classifiers is largely different from that of nouns, because a major function of classifiers is to provide semantic information that nouns do not carry. Specifically, while the noun lexicon is structured hierarchically around taxonomic relations, classifier systems are usually organized around semantic features such as animacy, shape, function, size, rigidity, or social importance (Croft, 1994). Let us look at some examples from Chinese classifiers. *Ba* is used for objects with a handle or those that are grasped by the hand (e.g., umbrella, screw driver, broom, key, or comb). *Tiao* is used for objects which are long and curved or flexible, including many things from different taxonomic categories – fish, dogs, rivers, roads, pants, and more – even crossing the animate–inanimate boundary. *Zhang*, is a common classifier for flat things (or things with a flat surface) including tables, beds, papers, plates, etc. *Tou* is a classifier for big animals like cows, elephants, rhinos, etc. This classifier partly overlaps with the taxonomic superordinate category of *animal*, but unlike a taxonomic category, the category members of *tou* and other animal classifiers are determined by size, and not by biologically based families of species.

Given that the numeral classifier system classifies objects in the world in ways that are largely different from nouns, it is naturally interesting to ask whether the presence of classifiers affects concepts of people who speak a classifier language. This of course is a question of linguistic relativity. There are only a handful of empirical studies that investigated this question for adult speakers (Zhang and Schmitt, 1998; Saalbach and Imai, 2007; Gao and Malt, 2009; Huettig et al., 2010), all supporting a weak version of linguistic relativity. For example, Huettig et al. (2010) showed that when adult Chinese speakers heard a classifier in a sentence, they shifted their attention to classifier-match objects (that was not mentioned in the sentence). However, when the classifier was not presented in speech, this eye-gaze shift was not observed.

The cognitive influence of classifiers has not been much explored in young children. In this research, we take the first steps toward exploring whether the use of a classifier system affects young children's concepts in any significant ways. Researchers have reported that the acquisition of classifiers is slow, especially in production (e.g., Carpenter, 1991); however, other researchers have demonstrated that comprehension of classifier semantics starts as early as four years in children (Uchida and Imai, 1999; Yamamoto and Keil, 2000; Saalbach et al., 2004), and the influence of classifiers may emerge before children have acquired proficiency in production (see Imai and Gentner, 1997; Imai and Mazuka, 2007, concerning the influence of count/mass vs. classifier grammatical system on the construal of object individuation).

Given these previous results and the semantic nature of classifier categories – the fact that classifiers classify objects in a way that largely cross-cuts taxonomic categories and the fact that shape is universally an important semantic feature across different classifier languages – , it is possible that classifier categories affect children's concepts in some ways. In fact, it has been widely known that young children project categories on labels, and consequently generalize novel properties to object sharing the same *noun* label (e.g., Gelman and Markman, 1986). However, it is not known whether children speaking a classifier language think that classifiers are useful for inductive generalization of properties and requires investigation. Thus, it is particularly important to see whether Chinese children would show stronger tendency to generalize a novel property to the similarly shaped (same-classifier) items as compared to German children.

To our knowledge, there has been only one study that directly examined the influence of a classifier system on children's object categories. Carrol and Casagrande (1958) tested whether the classifier system in Navaho influences children's classifications of novel artifact objects. Because shape is the most dominant dimension in the Navaho system of verb-stem classifiers, Carrol and Casagrande reasoned that Navaho-speaking children should attend more to shape similarity than to similarity in other perceptual dimensions. Consistent with this prediction, Navaho children who spoke Navaho predominantly (over English) were more likely to group objects on the basis of shape than on the basis of size or color compared to English-dominant Navaho age peers from the same community. However, different from the prediction, monolingual English-speaking preschoolers produced even more shape-based responses than the Navaho-dominant bilingual group. Thus, it is at best difficult to draw a conclusion from their results about whether classifiers affect children's concepts and categories.

One important issue when examining the potential influence of classifiers on children's cognition is how the influence, if any, is manifested in different cognitive tasks. Three kinds of relations, taxonomic relations, shape similarity, and thematic relations, have been described as major organizers of young children's concepts. However, different results have been reported and different conclusions have been drawn concerning *which* of the three types of relation children rely on the most. For example, it has been often noted that young preschoolers tend to categorize objects based on thematic relations (Smiley and Brown, 1979) but they do not do so in the context of label extension (e.g., Markman and Hutchinson, 1984). However, when young children are asked to extend novel labels, they no longer show preference for thematic relations. For example, children extend labels on the basis of shape similarity over thematic relations or taxonomic relations (e.g., Landau et al., 1988; Baldwin, 1992; Imai et al., 1994). To make the story even more complex, it has been demonstrated that young children do show reliance on taxonomic relations over shape similarity in a different context, namely, when they are asked to draw an inductive inference about a novel property (e.g., Gelman and Markman, 1986; Imai, 1996). Thus, children appreciate multiple kinds of conceptual relations and flexibly shift among them according to the cognitive process required by the task at hand (Waxman and Namy, 1997). In that case, it makes the most sense for tests of the influence of classifier categories on children's cognitive structure to be done with multiple tasks rather than with a single task, as the influence of classifiers may interact with task-specific cognitive processes. This possibility is in fact suggested by our previous results with adults.

Saalbach and Imai (2007, see also Imai and Saalbach, 2010) examined the relative importance of three types of relations – taxonomic, thematic, and classifier relations – for adult Chinese and German speakers across similarity judgments, inductive inference of novel properties, and fast-speed picture–word matching tasks. They found that, although the influence of the same-classifier relation was found in the similarity judgment task and in the inductive reasoning task with a novel, unknown property, it was not found in the inductive reasoning task in which participants were asked to draw an inductive inference about a known property ("carry the same bacteria"). The language-specific classifier effect vanished here presumably because adults had some background knowledge about what could be (and could not be) a carrier of the same bacteria, and they utilized this knowledge over similarity in their reasoning. Taken together, it is important to examine the potential influence with multiple task contexts that require different cognitive processes. This in turn will reveal how pervasive the influence of classifier categories is, and how it interacts with task-specific cognitive processes.

PRESENT RESEARCH

To examine whether classifier categories affect young children's conceptual representation, we tested Chinese and German speakers in two age groups (3-year-olds, 5-year-olds) on a match-to-the standard generalization paradigm in three different contexts: non-lexical classification (Study 1), label extension (Study 2), and property inference (Study 3). We chose to include the label extension and property induction tasks in addition to the non-lexical categorization task because these two have been widely used to access young children's conceptual structure, and have often been noted to reveal young children's cognitive ability more sensitively than a non-lexical categorization task. If we find the influence of classifier categories in all three tasks, we could conclude that the classifier influence is very pervasive. Previous research in the literature suggests an important developmental change both in the proficiency and the comprehension of classifier use between 3 and 5 years of age (e.g., Uchida and Imai, 1999; Yamamoto and Keil, 2000; Saalbach et al., 2004). We thus tested children at these two ages to see how the classifier influence interacts with proficiency in knowledge of classifiers.

In all three contexts, a child was shown a picture of the standard object (e.g., banana), and was asked to make a choice out of the three test items: a taxonomic item (grape), a shape item (feather), and a thematic item (monkey). The shape item belonged to the same shape classifier category as the target. Thus, for Chinese children, the shape items can be considered as same-classifier items with a few exceptions (see the Stimuli section below). In Study 1, the participants were asked to form a category freely without invocation of any labels or classifiers. They were simply asked to select the item that best matched the standard object. In Study 2, the participants were asked to extend a novel label that was given to the standard. In Study 3, a novel non-perceptual property about the standard object was taught, and the participants were asked to select the item that would be most likely to have the same property.

If there is an influence of classifier categories, Chinese children are expected to pay more attention to shape similarity than German children, given that shape is a prominent semantic feature in classifier categories. Among the three tasks, the non-lexical classification task places the weakest constraints on the kind of knowledge that should be accessed. In our previous study with Chinese- and German-speaking adults (Saalbach and Imai, 2007), the classifier influence was observed most strongly in the similarity judgment task, in which participants were allowed to evaluate similarity between the target and the test items freely, using whatever conceptual and perceptual information they had available. Thus, if the classifier influence interacts with the task in children as well, we may expect to find the largest cross-linguistic difference in the non-lexical classification task. On the other hand, it is possible that the classifier influence is pervasive and strong enough to modify children's categorization even in the context of novel label extension or inductive generalization of a property. Previous results show that preschool children in general tend to extend novel labels on the basis of shape, but Chinese children may show an even stronger shape bias than German children. It is also of greatest interest to see whether the classifier system influences Chinese children's inductive inference as well because classifier categories cross-cut taxonomic categories.

The present research is also important in light of the relation between culture and cognition. Some researchers have proposed that the philosophy, values and customs that have been nursed in a culture throughout its history lead to a "culturally specific" style of cognition (e.g., Nisbett et al., 2001; Nisbett, 2003; Ji et al., 2004). In particular, these researchers focused on comparisons of East Asians and Westerners. Characterizing the former as "holistic," and the latter as "analytic," they argued that while East Asians tend to view the environment as a unified whole and pay much attention to relations that tie together elements in the environment, Westerners tend to focus individual elements of the environment separately. Based on this scheme, a specific prediction was that East Asians, with their predisposition to see a scene or event as a whole, would categorize the world around thematic relations, while Westerners, with their focus on properties of individual objects, would categorize the world according to taxonomic relations (Ji et al., 2004). From this viewpoint, Chinese children should show a preference for thematic relations rather than shape (classifier) relations, especially in the non-lexical classification task (which was most similar to Ji et al.'s study with Chinese adults).

It is again important to examine the cultural effect with multiple tasks in order to evaluate the hypothesis in a global picture of cognition. If the cultural effect is pervasive and alters people's conceptual structure fundamentally, as proposed by Nisbett (2003), we would expect the effect to go over and above the base-line task-specific biases: Chinese children would show a stronger thematic bias than German children even in the label extension and property induction tasks, in which children in Western culture (mostly American) have been noted to show a shift away from thematic relations (e.g., Markman and Hutchinson, 1984; Gelman and Markman, 1986; Imai et al., 1994). On the other hand, it is possible that the scope of the cultural influence is limited to cognitive tasks that pose only weak or no task-specific constraints with respect to the basis of categorization, as shown in adults in Saalbach and Imai (2007).

The present study provides us with a unique opportunity to directly compare the influence of linguistic categories (i.e., classifiers) and that of culture. If the classifier influence is stronger, we should expect preference for shape over thematic response in Chinese children; if the influence of culture is stronger, the reverse preference would be expected.

EXPERIMENT 1: NON-LEXICAL CLASSIFICATION

MATERIALS AND METHODS

Participants

Native Mandarin-speaking children and native German-speaking children from two age groups were recruited through preschools they were attending, and were tested at their preschools with parental consent. In the Chinese sample, there were 16 3-year-olds (mean age: 3;6, ranging from 3;0 to 4;1, eight girls and eight boys) and 16 5-year-olds (mean age: 5;7, ranging from 5;1 to 6;2, eight girls and eight boys). In the German sample, there were 15 3-year-olds (mean age: 3;5, ranging from 2;11 to 4;2, 11 girls and 4 boys) and 15 5-year-olds (mean age: 5;5, ranging from 4;11 to 6;0, eight girls and seven boys). The children in both language groups in this and the other two studies reported in this paper were living in big cities (Beijing and Berlin) and were mostly from middle class families. The range and mean age of children in each age group were comparable across the two language groups. This research was approved by the ethics committees at Keio University at Shonan-Fujisawa Campus and at ETH Zurich.

Materials

Twelve item sets of four color drawings of familiar objects were prepared. Each set consisted of a standard item, a taxonomic item, a shape item, and a thematic item. Of the 12, four sets represented animal categories, four represented plants, and four represented artifacts (see **Table 1**). The shape item belonged to the same classifier category as the target except for the two sets, those with a salamander and a beaver as the targets. The classifier for these two animals was *zhi*, a classifier for small animals. The classifier for the shape items (which had to be non-animals) for these sets was *tiao*, the classifier for long-thin and flexible things. In the analysis, we checked the results both including and excluding these two sets, but there was no difference.

Table 1 | Materials of Experiments 1–3.

Set	Standard	Taxonomic	Shape	Thematic
	ANIMAL			
1	Snake	Turtle	Jump.rope	Glass cage
2	Eel	Guppy	Belt	Water tank
3	Salamander	Frog	Scarf	Pond
4	Beaver	Cat	Tie	Logs
	PLANT			
5	Banana	Grape	Feather	Monkey
6	Apple	Cucumber	Ball	Knife
7	Carrot	Tomato	Match	Rabbit
8	Onion	Peppers	Candle	Frying pan
	ARTIFACT			
9	Hat	Turban	Tent	Head
10	CD	Tape	Pizza	Stereo
11	Necklace	Ring	Ribbon	Neck
12	Comb	Brush	Knife	Hair

Procedure

The participants with parental consent in both language groups were individually tested by a trained native speaker in a quiet room in their preschool or in a university laboratory. The children were shown each set of the pictures, one set at a time, and were asked to select the object that "best matches" the standard object. The instruction was given in the participants' language by a native speaker. As often pointed out, it is extremely difficult to assure that the instructions are perfectly equivalent across different languages (e.g., Boroditsky, 2001). Thus, special care was taken to make the instructions (for this and the following experiments) in each language as similar as possible as and also to avoid any response bias due to the instructions, by consulting a number of language and child care specialists (mostly linguists, developmental psychologists, and preschool teachers) in each country. The actual Chinese and German instructions are provided in the Section "Chinese and German Instructions for Experiment 1" in Appendix.

RESULTS AND DISCUSSION

The mean proportion for the shape, taxonomic, and thematic responses are given in **Table 2**. The distribution of the three responses looked different as a function of Age and Language. As mentioned earlier, in two sets, the classifier for the shape choice item was different from the classifier for the target object. We thus conducted analyses both including and excluding these two sets for this and the other two studies reported in this paper. As the results were unchanged, we report the results in which the two sets were included.

Chinese children, both 3- and 5-year-olds, made the shape (the same-classifier) response most frequently. German 3-year-olds showed no particular preference across the three items. In contrast, German 5-year-olds showed clear preference for thematic relations (62.8%) in this non-lexical classification. In each Age/Language group, we classified the participants into four categories according to the response dominance (**Table 3**). The child was considered a Shape Dominant individual when she or he made Shape response seven times or more. The Taxonomic and Thematic Dominant individuals were determined likewise. The children who did not make a particular response type seven times or more were classified as No Dominance individuals. The distribution of individuals across the four dominance categories was submitted to an asymmetric log-linear model with the Response Dominance as the dependent variable and Age and Language as independent variables. A saturation model revealed that the Age × Language interaction did not make any significant contribution to the model fit. We thus deleted the interaction and employed the main effect model. Age and Language both made a significant contribution to the model, $\chi^2(3) = 10.49$ and 8.33, respectively, both ps < 0.05. The pattern of the parameter estimates suggests that the main effect of Age mainly came from a decrease of Shape Dominance and an increase of Thematic Dominance with age, and the effect of Language came from the higher proportion of the Shape Dominance individuals in the Chinese group than in the German group. To summarize, the children's non-lexical classification behavior was consistent with the hypothesis that classifier categories do affect Chinese-speaking children's categorization. But the results are incongruous with the hypothesis that East Asians organize their concepts around thematic relations and Westerners organize them around taxonomic relations (e.g., Nisbett, 2003; Ji et al., 2004), as it was German children who showed a strong thematic bias.

EXPERIMENT 2: LABEL EXTENSION

MATERIALS AND METHODS

Participants

Eighteen 3-year-old and 17 5-year-old Chinese children participated. As in Experiment 1, they were all from Beijing, and were native speakers of Mandarin Chinese. Fifteen German 3-year-olds and 15 5-year-olds also participated. They were living in Berlin and were native speakers of German.

Materials and procedure

The stimulus materials and the procedures were the same as those in Experiment 1 except for the instructions. Preschoolers were told that they were helping a puppet who was learning new words in Puppet language.

Table 2 | Mean frequency, standard deviation, and percentages of choices in each task, language, and age.

	Chinese			German		
	Taxonomic	Shape	Thematic	Taxonomic	Shape	Thematic
EXP1: NON-LEXICAL						
3-Year	31.8% (18.8)	52.6%* (21.8)	16.7%* (11.3)	42.8% (17.8)	25.6% (13.5)	33.3% (18.7)
5-Year	15.6%* (22.9)	47.4% (40.2)	37.0% (39.5)	19.4%* (21.1)	17.8% (26.1)	62.8%* (35.2)
EXP2: LABEL EXT.						
3-Year	28.2% (16.5)	63.4%* (20.3)	8.3%* (12.5)	27.8% (24.5)	57.8%* (20.8)	14.4%* (14.9)
5-Year	27.9% (24.5)	61.3%* (32.0)	10.8%* (14.7)	32.2% (17.8)	56.7%* (20.8)	11.1%* (14.9)
EXP3: PROPERTY IND.						
3-Year	41.7% (26.9)	37.5% (29.3)	20.8%+ (20.2)	41.7% (19.9)	34.4% (19.1)	23.9% (17.5)
5-Year	64.1%* (18.2)	27.6% (20.4)	8.3%* (8.1)	65.0%* (20.7)	18.3%* (20.7)	18.9%* (13.7)

T-tests have been conducted to test whether the rate of a particular choice is significant different from chance level.
**Denotes significantly different from chance level, p < 0.05 (based on Bonferroni adjusted probabilities).*
+Denotes marginally different from chance level, p < 0.1 (based on Bonferroni adjusted probabilities).

Table 3 | Frequencies of response dominance type in each task, language and age.

	N	TAX	SHAPE	THEME	NON
EXP1					
3-Year					
CH	16	1 (6.3%)	6 (37.5%)	2 (12.5%)	7 (43.8%)
GER	15	4 (26.7%)	0 (0%)	2 (13.3%)	9 (60.6%)
5-Year					
CH	16	2 (12.5%)	8 (50.5%)	4 (25.0%)	2 (12.5%)
GER	15	1 (6.7%)	2 (13.3%)	9 (60.0%)	3 (20.0%)
EXP2					
3-Year					
CH	18	1 (5.6%)	11 (61.1%)	0 (0%)	6 (33.3%)
GER	15	0 (0%)	8 (53.3%)	0 (0%)	7 (46.7%)
5-Year					
CH	17	3 (17.6%)	9 (52.9%)	0 (0%)	5 (29.4%)
GER	15	2 (13.3%)	9 (60.0%)	0 (0%)	4 (9.1%)
EXP3					
3-Year					
CH	16	5 (31.3%)	5 (31.3%)	2 (12.5%)	4 (25.0%)
GER	15	4 (26.7%)	2 (13.3%)	1 (10.0%)	8 (53.3%)
5-Year					
CH	16	12 (75.0%)	2 (12.5%)	0 (0%)	2 (12.5%)
GER	15	11 (73.3%)	2 (13.3%)	0 (0%)	2 (13.3%)

For each set, the experimenter assigned a novel label to the standard and asked the child which of the three choice alternatives the label should be applied to (see Section "Chinese and German Instructions for Experiment 2" in Appendix for the actual Chinese and German instructions).

RESULTS AND DISCUSSION

In sharp contrast to Experiment 1, the children's behavior was surprisingly similar across the two language groups. Chinese and German children, both 3- and 5-year-olds, selected the shape alternatives most frequently and at above chance level. The mean proportion for the shape, taxonomic, and thematic responses are given in **Table 2**.

As in Experiment 1, we classified children into four categories of Shape Dominant, Taxonomic Dominant, Thematic Dominant, and No Dominance individuals (**Table 3**) and conducted a 2 (Language) × 2 (Age) × 4 (Response Dominance) asymmetric log-linear model with the Response dominance as the dependent variable. Different from Experiment 1, the model revealed no main effects for Age, Language, or the interaction effect, all $ps > 0.5$.

To summarize, first, consistent with previous results found in English-speaking children (e.g., Markman and Hutchinson, 1984), both Chinese- and German-speaking children categorized differently in the contexts of label extension and non-lexical classification. Second, when shape similarity and taxonomic relations were pitted against each other, both Chinese- and German-speaking children extended a label on the basis of shape similarity rather than taxonomic relations, which is also consistent with previous studies with English-speaking children (e.g., Baldwin, 1992; Imai et al., 1994). Here, different from Experiment 1, there was no cross-linguistic difference between Chinese and German children, as children in both languages dominantly extended labels on the basis of shape similarity. This suggests that, as in the case with adults (Saalbach and Imai, 2007), the nature of the task – that is, what type of information and/or knowledge is most relevant for the inference – affected categorization behavior and interacted with the classifier effect. Here, the influence of classifier categories we observed in Experiment 1 was washed away by the task-specific cognitive bias (i.e., the shape bias).

Again, we found no evidence for the culture-specific cognition hypothesis: There was no difference between German and Chinese children.

EXPERIMENT 3: PROPERTY GENERALIZATION

MATERIALS AND METHODS

Participants

In the Chinese sample, there were 16 3-year-olds and 16 5-year-olds, all living in Beijing and native speakers of Mandarin-Chinese. In the German sample, there were 15 3-year-olds and 15 5-year-olds. They were living in Berlin, and their native language was German.

Materials and procedure

The same materials were used as in the previous experiments. In each set, the experimenter taught a novel internal property about the standard object and asked the children to select the item that also had this property (see Section "Chinese and German Instructions for Experiment 3" in Appendix for the Chinese and German instructions).

RESULTS AND DISCUSSION

The response pattern was again very similar across the two language/culture groups (see **Tables 2 and 3**). However, different from the label-extension case, a dominance of shape response was no longer observed even for the 3-year-olds, although 3-year-olds did not select the taxonomic item at above chance level; the 5-year-olds in both language groups strongly projected novel properties based on taxonomic relations. Each participant was again classified into one of the four response dominance categories, and an asymmetric log-linear model was fitted on a 2 (Language) × 2 (Age) × 4 (Response Dominance) contingency table. The model revealed a main effect for age, $\chi^2(3) = 9.34$, $p < 0.01$. There was no main effect for Language, nor was there an interaction effect, both $ps > 0.5$. The pattern of parameter estimates suggests that the difference between the two age groups mainly came from the distribution of the Taxonomic dominant individuals, 5-year-olds showing more taxonomic responses than 3-year-olds.

The cross-linguistic *similarity* between Chinese and German speakers was striking. This converged with the results of Experiment 2 to suggest that, when children have inherent bias which affects the task, a language or culture-specific effect may disappear.

Both Chinese and German 5-year-olds generalized a novel property on the basis of taxonomic category membership. This finding confirms the widely accepted notion that young children, just like adults, assume that taxonomic categories carry higher inductive potential than perceptual similarity (e.g., Gelman and Markman, 1986; Gelman, 2003). In both language groups, 3-year-olds' taxonomic choice did not exceed from chance, thus a strong taxonomic bias appears to emerge between 3- and 5-year-olds. However, it should be noted that they did not show a strong preference for a shape choice as they did in extending a novel label in Experiment 2. Thus, even 3-year-olds were aware that object shape would not be a good basis for inductive inference. This converges with the results from the Chinese adults in Saalbach and Imai (2007) to suggest that speakers of a classifier language, including even preschool-age children, do not consider classifier categories as carrying high inductive potential. The results are also important in establishing that label extension and property induction do not reflect exactly the same type of knowledge or cognitive processes. We discuss the difference between label extension and property induction in more detail in the Section "General Discussion."

GENERAL DISCUSSION

SUMMARY OF RESULTS FROM THE THREE STUDIES

In this research, we investigated whether the classifier system in the Chinese language influences young children's conceptual structure in three cognitive tasks, i.e., (non-lexical) categorization, label extension and inductive generalization of a property. The structure of the stimuli also allowed us to test a specific hypothesis proposed from cultural psychology (e.g., Nisbett et al., 2001; Nisbett, 2003; Ji et al., 2004), giving us an excellent opportunity to examine whether language (the classifier system) or culture (Western vs. Eastern difference in the preference for taxonomic vs. thematic relations) affects young children's categorization.

We found a complex interplay between the effect of classifiers and children's task-specific biases. We found some support for linguistic relativity, as Chinese preschoolers used shape similarity as a basis for non-lexical categorization at a higher rate than German preschoolers. At the same time, however, this cross-linguistic difference was not observed in the label extension or property inference tasks. In the former case, not only Chinese- but also German-speaking children predominantly extended novel labels on the basis of shape similarity, replicating the results with English-speaking children in previous similar studies (e.g., Baldwin, 1992; Imai et al., 1994). In the latter case, children did not rely on shape in generalizing a novel property to other objects. In fact, both Chinese and German 5-year-olds generalized the properties on the basis of taxonomic relations. It is important to note that, in our task, the children were not taught that the taxonomic item shared the label with the standard object, unlike the well-known property induction studies in the literature (e.g., Gelman and Markman, 1986). In other words, the children in our study not only determined that taxonomic relations were likely to carry the highest inductive potential, but also recruited the relevant taxonomic knowledge on their own.

In contrast to the effect of classifiers, in no task, we found the cross-cultural difference between Westerners (German) and East Asians (Chinese) predicted by the culture-specific cognition hypothesis proposed by Nisbett and colleagues (Nisbett et al. 2001; Nisbett, 2003; Ji et al., 2004).

TASK-SPECIFIC BIASES AND CLASSIFIER INFLUENCE

The finding that the influence of classifiers interacts with task-specific biases is important not only for understanding linguistic relativity but also for understanding the nature of young children's concepts and categories itself. The fact that children relied on different relations 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 and 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.

The difference across label extension and property generalization is particularly noteworthy and requires further exploration. Why should children rely on shape when making inferences about what other object can be labeled by the novel label, even though they are able to access taxonomic relations when making inferences as to which other objects the novel property can be generalized?

Young children constantly encounter new words, and often need to extend newly heard words even when they do not have much knowledge about the referent objects. In such cases, among the features that children have access to even without rich domain knowledge, shape is the best predictor for taxonomic categories, and in particular, for basic level categories (Imai et al., 1994). Given that children first learn basic level object names, it is probable that children have extracted this pattern from their early word learning experience and apply it even when learning non-basic level words such as superordinate category names (e.g., Imai et al., 1994; Smith et al., 2002). Furthermore, object names are often extended to other same-shape objects of different kinds. For example, we may call a bunny-shaped chocolate "a bunny" even when it is really a piece of chocolate and not a rabbit. This kind of lexical convention may have enhanced the reliance on shape in label extension.

Shape similarity is not as useful for inductive generalization of properties as it is for label generalization. Not every property of an object can be generalized to other objects, and even when a property is generalizable, the scope of generalization depends on the nature of the property. For example, some properties are true for all animals, but other properties are true only for a particular species. In other words, one needs a fair amount of the domain knowledge about the object and the property in question to be able to make a meaningful inference (cf., Gelman et al., 1986; Imai, 1996). By 3 years of age, young children, regardless of their ambient language and culture, may have noticed this, and realized that projecting an unfamiliar (internal) property instantly on the basis of shape does not take them very far.

The result that an influence from the classifier system is found only in the non-lexical categorization task is consistent with the results from previous research examining classifier influence in adults (Saalbach and Imai, 2007). In Saalbach and Imai (2007), the classifier effect (i.e., the difference between Chinese and German speakers on the same-classifier items) was found in a similarity judgment task but not in an inductive reasoning task, where the participants were asked to judge the likelihood with which the test item carried the same kind of bacteria as those found in the target object. The similarity judgment task was much less constrained than the property reasoning task in that the participants were free to weigh the taxonomic, thematic, or perceptual relations between the target object and the same-classifier test object in judging the similarity. The inference about the "bacteria" property should be more constrained because adult participants are likely to have had some prior knowledge of bacteria. Any classifier effect was too subtle to be seen in the face of the prior knowledge about carriers of bacteria.

Thus, just 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 tasks. In fact, the cross-linguistic/cultural similarity of the Chinese and German children in the label extension and property generalization tasks is striking. Any cognitive bias due to classifiers may be too weak in the face of task-specific biases (such as the shape bias for label extension and taxonomic bias for property inference) that have been identified across many different language/culture groups. This in turn suggests that, if any evidence for linguistic relativity is found, it is important to specify the magnitude and scope of the effect within a larger picture of universally prominent tendencies in cognition.

The timing of the emergence of the language-specific classifier influence in the non-lexical categorization should be interpreted with caution. The results of the statistical analyses in Experiment 1 revealed main effects of Language with Chinese children showing a stronger preference for shape response and of Age with an increase of thematic response compensated by decrease of shape response, with no interaction between the two factors. Thus, we may conclude that the classifier influence in the non-lexical categorization is seen even at age 3, that is, even before Chinese children start to use classifiers proficiently. However, the distributions of the means in **Tables 2 and 3** seem to pose somewhat more complex picture. Further exploration is necessary concerning this issue.

THEMATIC BIAS IN GERMAN CHILDREN

To some readers, the fact that German 5-year-olds showed a thematic (but not a taxonomic) bias in the non-lexical categorization (Experiment 1) may seem puzzling. However, this result is not so surprising in light of previous results in the adult concept literature. Recently, researchers have noted that taxonomic relations do not capture the full spectrum and richness of human concepts and categories, and they have pointed out that thematic relations are also an integral and important part of our conceptual structure (e.g., Wisniewski and Bassok, 1999; Lin and Murphy, 2001; see also Bassok and Medin, 1997). Lin and Murphy (2001, see also Markman, 1989) suggest that many human concepts include knowledge about non-taxonomic relations, with thematic relations being the most important sort of knowledge among them. In fact, in our previous research (Saalbach and Imai, 2007), German adults also showed a preference for thematic-based over taxonomic-based categorization. Thus, there are grounds to suspect that thematic relation is a major organizer of concepts not only for East Asians but also for people in the Western culture.

Great caution is necessary to interpret the lack of evidence in this research for the culture-specific cognition hypothesis proposed by Nisbett and colleagues (Nisbett, 2003; Ji et al., 2004), however. Saalbach and Imai (2007) in fact found relatively stronger thematic preference in adult Chinese speakers as compared to German speakers in a similarity rating task but not in a forced choice categorization task. Thus, it is not possible to rule out the possibility that the forced choice paradigm in this research was not sufficiently sensitive to reveal a culture-specific thematic bias in Chinese children. Considering that the pattern of results in the non-lexical categorization task – that German 5-year-olds showed a strong thematic bias while Chinese 5-year-olds showed a shape bias – this possibility is somewhat unlikely; nonetheless, further research is necessary to explore this result. It is quite plausible that culture affects how we perceive the world, how we group objects, and how we reason about objects in some ways. However, this influence may be more nuanced than what was argued by these authors (especially see Ji et al., 2004), as the results of this research suggest that influence of culture may be overridden by linguistic categories that push cognition toward a different direction. The culture effect may be better witnessed in cognitive domains that involve more complex reasoning or inferences than in the tasks employed in this research (e.g., Choi et al., 1997).

That said, our research is important in that it allowed us to directly compare the influence of language (although limited to the influence of the classifier system) and influence of culture. The results from the non-lexical categorization task suggest that the effect of language is stronger than the effect of culture on children's categorization.

LINGUISTIC RELATIVITY VS. THINKING FOR SPEAKING

One issue that also warrants some discussion is whether the results from Experiments 2 and 3 are relevant to linguistic relativity. Some researchers argue that linguistic relativity should be tested only in purely non-linguistic tasks (e.g., Boroditsky, 2001; Lucy and Gaskins, 2001), and should be distinguished from influence of language on the use of language (cf. the "thinking for speaking" proposal by Slobin, 1987; cf. Vigliocco et al., 2005). In this view, our novel property generalization and novel label extension tasks may not be relevant to linguistic relativity. However, it is extremely difficult to determine whether what counts as a "purely" non-linguistic task. Strictly speaking, even a non-lexical categorization task may not be a purely non-linguistic task because people may implicitly access existing labels for the objects and use this knowledge for the categorization task (e.g., Vigliocco et al., 2005).

In our view, the distinction between linguistic relativity and thinking for speaking may not be so critical. Recent studies have revealed that labels existing in the lexicon are automatically recruited during the course of perceptual processing in which no use of language is required (e.g., Roberson et al., 2008; Thierry et al., 2009). If so, a "purely non-linguistic" situation may be implemented only through a very artificial manipulation such as verbal shadowing (e.g., Hermer-Vazues et al., 1999; Winawer et al., 2007), but situations like this scarcely exist in normal everyday cognitive activities. Second, and more important, developmental researchers have long pointed out that non-lexical categorization may not be the best way for accessing young children's conceptual structure and cognitive abilities: because non-lexical categorization tasks are unconstrained and leave children with multiple bases for categorization, children often form non-systematic categories using mixed criteria such as shape, color, thematic relations, category relations, etc. simultaneously (e.g., Inhelder and Piaget, 1964; Bruner et al., 1966). However, once categorization is embedded in a task context of novel label extension or novel property generalization, young children's performance becomes more principled, using taxonomic relations or same-shape relations as bases for categorization (e.g., Gelman and Markman, 1986; Waxman, 1991; Imai et al., 1994). In other words, novel label extension and property generalization tasks have been used as more sensitive measures to uncover young children's conceptual structure than a non-lexical categorization task. Considering this, including these tasks in our research should be justified to examine the influence of classifies, whether the effect should be interpreted as evidence for "linguistic relativity" or "thinking for speaking."

IMPLICATIONS FOR THE RELATIONS AMONG LANGUAGE, CULTURE, AND THOUGHT

This research provides important implications for the field of language and thought as well as for the field of cultural psychology. In traditional discussions of linguistic relativity, if a cross-linguistic difference is found between a language having a certain grammatical categorization system and one without it *in any task*, be it in similarity judgments, categorization, memory or inductive reasoning, it has been taken as evidence for linguistic relativity. Likewise, if researchers find cross-cultural difference that is consistent with a hypothesis about cultural influence in a particular task, it has been taken as evidence for the hypothesis without specifying the scope of the effect within a global picture of cognition. The results of this research suggest that the influence of linguistic categories (or culture) deeply interacts with task-specific cognitive constraints and availability of background knowledge. This in turn highlights the importance of examining the influence of language (or culture) not in light of *whether* there is one, but in light of *how large* the influence is within a broad range of cognitive processes. This is in harmony with a view that has become dominant in the recent literature, namely, a nuanced version of linguistic relativity: In thinking about the relation between language and thought, a simple Whorfian vs. non-Whorfian dichotomy is no longer tenable (see Imai and Saalbach, 2010 and other chapters in Malt and Wolff, 2010; see also Vigliocco et al., 2005; Gilbert et al., 2006; Roberson et al., 2008).

Yet to be seen is whether the classifier effect found in Chinese children is also seen in other classifier languages. Imai and Saalbach (2010) report that the classifier influence in adult Chinese speakers was not found in Japanese speakers, another classifier language. Chinese and Japanese are both classifier languages, but the two languages differ substantially in terms of the contexts in which classifiers are used (Downing, 1996). As a consequence, classifiers are used much more frequently in Chinese than in Japanese (see Imai and Saalbach, 2010 for a more detailed description of the difference between the Japanese and Chinese systems). Given this result, there are grounds to suspect that the classifier influence may not always be evident just because a given language has a classifier system. It will remain for future research to clarify whether the classifier influence found in the present research can be generalized to children speaking different classifier languages, and how syntactic or semantic properties of the classifier system in a given language interacts with the classifier influence on children's conceptual structures.

ACKNOWLEDGMENTS

This research was supported by Ministry of Education grant-in-aid for Scientific Research (#15300088) and research grants from Keio University (Keio Gijuku Academic Development Funds and Keio Gijuku Mori Memorial Research Fund) awarded to Mutsumi Imai, fellowships from the Japan Society of the Promotion of Science (JSPS) and Friedrich-Ebert-Stiftung awarded to Saalbach. We are deeply indebted to Zhou Xiaolin, Lennart Schalk, Li Lianjing, Zou Ling, and Miho Nagumo for help for data collection and discussion.

REFERENCES

Aikhenvald, A. (2000). *Classifiers: A Typology of Noun Categorization Devices*. New York: Oxford University Press.

Baldwin, D. A. (1992). Clarifying the role of shape in children's taxonomic assumption. *J. Exp. Child. Psychol.* 54, 392–416.

Bassok, M., and Medin, D. L. (1997). Birds of a feather flock together: similarity judgments with semantically rich stimuli. *J. Mem. Lang.* 36, 311–336.

Boroditsky, L. (2001). Does language shape thought? Mandarin and English speakers' conceptions of time. *Cogn. Psychol.* 43, 1–22.

Bruner, J. S., Olver, R., and Greenfield, P. (1966). *Studies in Cognitive Growth*. New York: Wiley.

Carpenter, K. (1991). Later rather than sooner: extralinguistic categories in the acquisition of Thai classifiers. *J. Child Lang.* 18, 93–113.

Carrol, J., and Casagrande, J. (1958). "The function of language classifications in behaviour," in *Readings in Social Psychology*, eds E. Macooby, T. Newcomb, and E. Hartley (New York: Henry Holt), 18–31.

Choi, I., Nisbett, R. E., and Smith, E. E. (1997). Culture, category salience, and inductive reasoning. *Cognition* 65, 15–32.

Craig, C. G. (1986). "Jacaltec noun classifiers: a study in language and culture," in *Noun Classes and Categorization*, ed. C. Craig (Philadelphia: John Benjamins), 263–293.

Croft, W. (1994). Semantic universals in classifier systems. *Word* 45, 145–171.

Denny, J. P. (1986). "The semantic role of noun classifiers," in *Noun Classes and Categorization*, ed. C. Craig (Philadelphia: John Benjamins), 297–308.

Downing, P. (1996). *Numeral Classifier Systems: The Case of Japanese*. Philadelphia: John Benjamins.

Gao, M. Y., and Malt, B. C. (2009). Mental representation and cognitive consequences of Chinese individual classifiers. *Lang. Cogn. Process.* 24, 1124–1179.

Gelman, S. A. (2003). *The Essential Child: Origins of Essentialism in Everyday Thought*. New York: Oxford University Press.

Gelman, S. A., Collman, P., and Maccoby, E. E. (1986). Inferring properties from categories versus inferring categories from properties: the case of gender. *Child Dev.* 57, 396–404.

Gelman, S. A., and Markman, E. M. (1986). Categories and induction in young children. *Cognition* 23, 183–209.

Gilbert, A. L., Regier, T., Kay, P., and Ivry, R. B. (2006). Whorf hypothesis is supported in the right visual field but not the left. *Proc. Natl. Acad. Sci. U.S.A.* 103, 489–494.

Hermer-Vazues, L., Spelke, E. S., and Katsnelson, A. S. (1999). Sources of flexibility in human cognition: dual-task studies of space and language. *Cogn. Psychol.* 39, 3–36.

Huettig, F., Chen, J., Bowerman, M., and Majid, A. (2010). Do language-specific categories shape conceptual processing? Mandarin classifier distinctions influence eye gaze behavior, but only during linguistic processing. *J. Cogn. Cult.* 10, 39–58.

Imai, M. (1996). "Asymmetry in the taxonomic assumption: word learning vs. property induction," in *Proceedings of the 27th Annual Child Language Research Forum*, ed. E. V. Clark (New York, NY: Cambridge University Press), 157–167.

Imai, M., and Gentner, D. (1997). A cross-linguistic study of early word meaning: universal ontology and linguistic influence. *Cognition* 62, 169–200.

Imai, M., Gentner, D., and Uchida, N. (1994). Children's theories of word meaning: the role of shape similarity in early acquisition. *Cogn. Dev.* 9, 45–75.

Imai, M., and Mazuka, R. (2007). Revisiting language universals and linguistic relativity: language-relative construal of individuation constrained by universal ontology. *Cogn. Sci.* 31, 385–414.

Imai, M., and Saalbach, H. (2010). "Categories in mind and categories in language: are classifier categories reflection of the mind?," in *Words and the Mind: How Words Capture Human Experience*, eds B. Malt and P. Wolff (New York: Oxford University Press), 138–164.

Inhelder, B., and Piaget, J. (1964). *The Early Growth of Logic in Children*. New York: Norton.

Ji, L.-J., Zhang, Z., and Nisbett, R. E. (2004). Is it culture or is it language? Examination of language effects in cross-cultural research on categorization. *J. Pers. Soc. Psychol.* 87, 57–65.

Landau, B., Smith, L. B., and Jones, S. S. (1988). The importance of shape in early lexical learning. *Cogn. Dev.* 59, 299–321.

Lin, E. L., and Murphy, G. L. (2001). Thematic relations in adults' concepts. *J. Exp. Psychol. Gen.* 130, 3–28.

Lucy, J. A., and Gaskins, S. (2001). "Grammatical categories and the development of classification preferences: a comparative approach," in *Language Acquisition and Conceptual Development*, eds M. Bowerman and S. C. Levinson (Cambridge: Cambridge University Press), 257–283.

Malt, B., and Wolff, P. (2010). *Words and the Mind: How Words Capture Human Experience*. New York: Oxford Press.

Markman, E. M. (1989). *Categorization and Naming in Children: Problems of Induction*. Cambridge: The MIT Press.

Markman, E. M., and Hutchinson, J. E. (1984). Children's sensitivity to constraints on word meaning: taxonomic versus thematic relations. *Cogn. Psychol.* 16, 1–27.

Nisbett, R. E. (2003). *The Geography of Thought: How Asians and Westerners Think Differently…* and Why. New York: Free Press.

Nisbett, R. E., Peng, K., Choi, I., and Norenzayan, A. (2001). Culture and systems of thought: holistic versus analytic cognition. *Psychol. Rev.* 108, 291–310.

Roberson, D., Pak, H. S., and Hanley, J. R. (2008). Categorical perception of colour in the left and right visual field is verbally mediated: evidence from Korean. *Cognition* 107, 752–762.

Saalbach, H., and Imai, M. (2007). The scope of linguistic influence: does a classifier system alter object concepts? *J. Exp. Psychol. Gen.* 136, 485–501.

Saalbach, H., Stern, E., and Zhou, X. (2004). "Mental representation and acquisition of Chinese classifiers, " in *Paper presented at the 28th International Congress of Psychology*, Beijing, China.

Senft, G. (2000). "What do we really know about nominal classification systems?" in *Systems of Nominal Classification*, ed. G. Senft (Cambridge: Cambridge University Press), 11–50.

Slobin, D. (1987). "Thinking for speaking," in *Proceedings of the 13th Annual Meeting of Berkeley Linguistic Society*, eds J. Aske, N. Beery, L. Michaelis, and H. Filip (Berkeley, CA: Berkeley Linguistic Society), 487–505.

Smiley, S. S., and Brown, A. L. (1979). Conceptual preference for thematic or taxonomic relations: a nonmonotonic trend from preschool to old age. *J. Exp. Child. Psychol.* 28, 437–458.

Smith, L. B., Jones, S. S., Landau, B., Gershkoff-Stowe, L., and Samuelson, L. K. (2002). Object name learning provides on-the-job training for attention. *Psychol. Sci.* 13, 13–19.

Thierry, G., Athanasopoulos, P., Wiggett, A., Dering, B., and Kuipers, J. (2009). Unconscious effects of language-specific terminology on pre-attentive colour perception. *Proc. Natl. Acad. Sci. U.S.A.* 106, 4567–4570.

Uchida, N., and Imai, M. (1999). Heuristics in learning classifiers: the acquisition of the classifier system and its implications for the nature of lexical acquisition. *Jpn. Psychol. Res.* 41, 50–69.

Vigliocco, G., Vinson, D., Paganelli, F., and Dworzynski, K. (2005). Grammatical gender effects on cognition: implications for language learning and language use. *J. Exp. Psychol. Gen.* 134, 501–520.

Winawer, J., Witthoft, N., Frank, M. C., Wu, L., Wade, A. R., and Boroditsky, L. (2007). Russian blues reveal effects of language on color discrimination. *Proc. Natl. Acad. Sci. U.S.A.* 104, 7780–7785.

Waxman, S. R. (1991). "Convergences between semantic and conceptual organization in the preschool years" in *Perspectives on Language and Cognition: Interrelations in Development*, eds J. Byrnes and S. Gelman (Cambridge: Cambridge University Press), 107–145.

Waxman, S. R., and Namy, L. L. (1997). Challenging the notion of a thematic preference in young children. *Dev. Psychol.* 33, 555–567.

Wisniewski, E. J., and Bassok, M. (1999). What makes a man similar to a tie? Stimulus compatibility with comparison and integration. *Cogn. Psychol.* 39, 208–238.

Yamamoto, K., and Keil, F. (2000). The acquisition of Japanese numeral classifiers: linkage between grammatical forms and conceptual categories. *J. East Asian Linguist.* 9, 379–409.

Zhang, S., and Schmitt, B. (1998). Language-dependent classification: the mental representation of classifiers in cognition, memory, and ad evaluations. *J. Exp. Psychol. Appl.* 4, 375–385.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 09 August 2010; accepted: 21 October 2010; published online: 08 December 2010.

*Citation: Imai M, Saalbach H and Stern E (2010) Are Chinese and German children taxonomic, thematic, or shape biased? Influence of classifiers and cultural contexts. Front. Psychology **1**:194. doi: 10.3389/fpsyg.2010.00194*

This article was submitted to Frontiers in Cultural Psychology, a specialty of Frontiers in Psychology.

APPENDIX

CHINESE AND GERMAN INSTRUCTIONS FOR EXPERIMENT 1

Chinese instruction

他叫 JOJO. JOJO 是一个小狼。 他很想学习。我们帮助他好吗？
你可不可以告诉 JOJO 它们(TAXONOMIC, SHAPE, THEMATIC ITEMS)的哪一个跟它 (TARGET) 最相配？

German instruction

Das ist JOJO. JOJO ist ein kleiner Wolf. Er möchte ganz viel lernen. ollen wir Ihm helfen? Kannst Du dem JOJO sagen welches dieser Dinge (TAXONOMIC, SHAPE, THEMATIC ITEMS) am besten mit diesem (TARGET) zusammen passt?

Approximate English translation

This is Jojo. Jojo is a little wolf. He really wants to study a lot. Let's help him, ok? Can you tell JOJO which one of these (TAXONOMIC, SHAPE, THEMATIC ITEMS) matches this one (TARGET) the best?

CHINESE AND GERMAN INSTRUCTIONS FOR EXPERIMENT 2

Chinese instruction (for one of the sets)

他叫 JOJO. JOJO 是一个小狼。 他很想学习狼的话。我们帮助他好吗？
看！这 (TARGET) 是 FIN4*. 你可不可以告诉 JOJO 这三个当中(TAXONOMIC, SHAPE,

German instruction (for one of the sets)

Das ist JOJO. JOJO ist ein kleiner Wolf. Er möchte ganz viel lernen. Wollen wir Ihm helfen? Wir haben ein Herz innen drin, weißt du das schon? Du weißt doch sicher auch, dass wir Blut innen drin haben, oder? Alle Dinge haben andere Dinge innen drin, stimmt's? Ich werde Dir jetzt verraten, was das hier (TARGET) innen drin hat. Das hier (TARGET) hat IDOFORM innen drin. Kannst Du dem JOJO sagen, welches von denen hier (TAXONOMIC, SHAPE, THEMATIC ITEMS) auch IDOFORM innen drin hat?

Approximate English translation

This is JOJO. JOJO is a little wolf. He really wants to study a lot. Let's help him, ok? We have a heart inside. Do you know this already? You also know that we have blood inside, right? All things have something inside, right? I will tell you what is inside this (TARGET). This (TARGET) has LIAN4 AN1*/IDOFORM inside. Can you tell JOJO which one of them (TAXONOMIC, SHAPE, THEMATIC ITEMS) has also IDOFORM inside?

CHINESE AND GERMAN INSTRUCTIONS FOR EXPERIMENT 3

Chinese instruction (for one of the sets)

他叫 JOJO. JOJO 是一个小狼。 他很想学习狼的话。我们帮助他好吗？
看！这 (TARGET) 是 FIN4*. 你可不可以告诉 JOJO 这三个当中(TAXONOMIC, SHAPE,

German instruction (for one of the sets)

Das ist JOJO. JOJO ist ein kleiner Wolf. Er möchte unbedingt Wolfssprache lernen. Wollen wir Ihm helfen? Guck mal! Das (TARGET) ist ein FEP. Kannst du dem JOJO sagen, welches von denen (TAXONOMIC, SHAPE, THEMATIC ITEMS) auch ein FEP ist?

Approximate English translation

This is JOJO. JOJO is a little wolf. He really wants to study wolf language. Let's help him, ok? See! This (TARGET) is a FIN/FEP. Can you tell JOJO which one of them (TAXONOMIC, SHAPE, THEMATIC ITEMS) is also a FIN/FEP?