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# Cross-linguistic Semantic Differences Influence Recognition of Pictures

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## Abstract

We compared recognition memory for pictures of family interactions in Indonesian – in which sibling terms are based on *relative age* – and English – in which sibling terms are based on *gender*. In Experiment 1, participants saw a set of pictures of family interactions and gave a verbal description of each picture. They later received a recognition test that included variants that altered either seniority relations or gender relations. The same method was used in Experiment 2, except that the recognition variants were changed to be *similar* families (with parallel relationships). During study, participants were asked either simply to remember the pictures (Experiment 2a) or to provide a verbal description (Experiment 2b). Results from both experiments suggest effects of language on memory, particularly when non-identical transfer is involved.

## Introduction

### The Whorfian Question

Does the language we speak influence the way we think? This question, out of favor for many years, has had a resurgence of interest (Gentner & Goldin-Meadow, 2003; Gumperz & Levinson, 1996). There is evidence (Bowerman & Choi, 2003; Sera et al., 2002; Choi, McDonough, Bowerman, & Mandler, 1999; Levinson, 1998) that linguistic distinctions may influence non-linguistic similarity and memory for scenes (but see Munnich, Landau, & Doshier, 2001; Li & Gleitman, 2002 for contrary evidence).

The recent investigations have mostly centered around perceptual arenas such as space, time and motion. However, classic studies in anthropological linguistics suggest that there are also substantial differences in semantic categories in social arenas such as kinship (Romney & D'Andrade, 1964; Danziger, 2001; Foley, 1997). It is important to test whether these linguistic differences have cognitive consequences. There are direct studies of the cognitive effects of social semantics. Boroditsky and Schmidt (2000) found effects of linguistic gender on people's encodings of objects. For example, they taught Spanish-English and German-English bilinguals English names for objects (such as "Mary" for a table) and found that people retained the names better when the gender was consistent with the gender of the noun in their first language. In addition,

bilinguals' English descriptions of the objects were consistent with the gender in their first language. Sera, et al. (2002) have also shown that gender retains semantic context in that cross-linguistic differences influence classification (Sera et al., 2002).

Our work explores an arena of social categories, namely kinship terms. As Malinowski (1930) noted, some dimensions seem likely to be universal in kinship systems—such as the gender of the person named, the age and/or generation relative to ego, and the gender of the linking relative. Nevertheless, kinship systems vary considerably in how these distinctions play out. Our study focuses on one pair of contrasting languages – English and Indonesian – which vary in the way they name sibling relations.

Indonesian makes a lexical distinction for whether a sibling is *older or younger*. The word *kakak* refers to older sibling while the word *adik* refers to younger sibling. For example,

(1)

Saya	mempunyai	seorang	kakak.
1 <sup>st</sup> pers. sing.	have	one (person)	older sib
	'I have an older sibling'		

In contrast to English *brother* and *sister*, the Indonesian sibling terms *kakak* and *adik* are gender-neutral. When an Indonesian refers to his/her siblings, he/she speaks not in terms of sister and brother but rather of older and younger. Thus, "How's your older sibling (*kakak*)?" is as natural in Indonesian as "How's your brother?" is in English.

Of course, both languages can specify both gender and seniority if desired. An English speaker could refer to "your younger brother" and an Indonesian to "your male younger-sibling"

(2)

Adikmu	laki-laki
younger sib.-your	male
'your younger-sibling boy'	

Thus, the Indonesian semantic system focuses on the relational seniority of siblings, whereas the English systems focus on gender. Our study investigates a) whether this linguistic difference matter to the way people think about family relations, and b) whether it affects the way people construe scenes involving families.

In our previous study (Anggoro & Gentner, 2003, Experiment 2) we used a recognition task to test whether the two languages induce different encodings. Indonesian and English speakers were shown a series of pictures: three kinship standards and their three corresponding family pictures, along with 21 other pictures (Figures 1 and 2). Participants were asked to remember the scenes for a later memory task. Recognition memory for the scenes was later tested using variants of the standard pictures. Memory for each standard was tested using two variants: the Seniority Variant, which preserved the seniority relation but altered the gender relation, and the Gender Variant, which preserved the gender relation but altered the seniority relation. There was a tendency for Indonesian speakers to make more false alarms to the Seniority Variants than to the Gender Variants, suggesting better memory for Seniority than for Gender. English speakers showed the reverse pattern. An ANOVA over language and variant type showed a marginally significant interaction between the two factors. Other results from the same set of studies also point to an influence of language on encoding and recognition. For example, relative to English speakers, Indonesian speakers showed greater sensitivity to changes in seniority than to changes in gender in a similarity task. These results suggest greater sensitivity to the dimension that is required in naming siblings in each language.

### The Current Study

Slobin (1987) has suggested in his *thinking for speaking* hypothesis that “[when] constructing utterances in discourse, one fits one’s thoughts into available linguistic forms.” In our current work we seek to test whether verbally describing the pictures would strengthen the language effect. In addition, we further explored the effects of a more challenging task that involved nonidentical transfer.

### Experiment 1

As in our previous study, Indonesian and English speakers were shown a series of pictures: the three kinship standards (as exemplified in the top picture in Figure 2) and their three corresponding family pictures (Figure 1), along with 21 other pictures (a total of 27 pictures). For each picture, participants were asked to describe the scenes and remember them for a later memory task. After a brief filler task, participants were given a recognition memory test. As in the previous study, the test included two variants: the Seniority Variant, which preserved the seniority relation but altered the gender relation, and the Gender Variant, which preserved the gender relation but altered the seniority relation

If describing the scenes leads participants’ encodings to be influenced by the semantics of their kinship systems, then Indonesian monolinguals will be relatively more sensitive to changes in relative age than to changes in gender, as compared to English monolinguals. Specifically, if verbal description heightens the effects of semantic

categories on encoding and recognition, then we should find a significant interaction between language and variant type.

### Method

**Participants** The participants were 15 Indonesian monolinguals and 13 English monolinguals, ranging in age from approximately 17 to 20 years old. Participants were either given credit or a small monetary compensation. Data from Indonesian speakers were collected in Jakarta, Indonesia. Data from English speakers were collected at Northwestern University and other areas near Chicago.

**Materials** The stimuli were three sets of pictures. One set (the Kitchen set) involved scenes of siblings performing a simple activity in the kitchen. The other two sets (the Ritual sets) involved ceremonies. Family pictures were used to introduce the ‘characters’ and make clear the sibling relations.

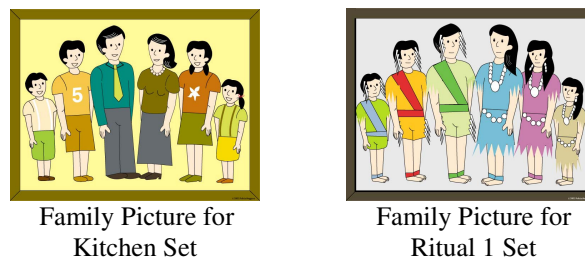


Figure 1: Family pictures used in the Kitchen and Ritual 1 sets.

The triad pictures consisted of one standard picture and two variants: the Seniority Variant, which preserved the seniority relation but altered the gender relation, and the Gender Variant, which preserved the gender relation but altered the seniority relation.

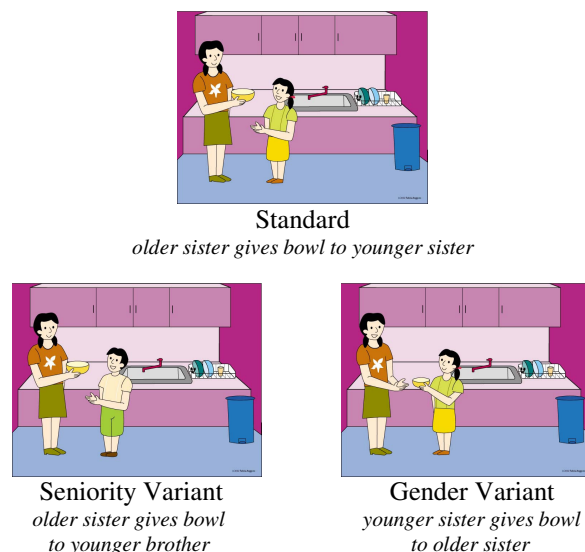
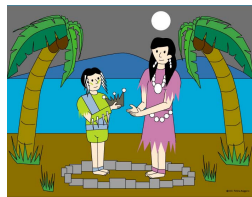


Figure 2: The Kitchen set. In the Seniority Variant, the bowl still goes from the older to the younger sibling, but the gender of the younger sibling is altered. In the Gender Variant, the gender of both actors is the same as in the standard, but the bowl now goes from the younger to the older sibling.



Standard  
younger brother gives crown  
to older sister



Gender Variant  
older sister gives crown  
to younger brother



Seniority Variant  
younger brother gives crown  
to older brother

Figure 3: Ritual 1 set. In the Gender Variant, the genders of both actors are the same as in the standard, but the crown now goes from the older to the younger sibling. In the Seniority Variant, the bowl still goes from the younger to the older sibling, but the gender of the older sibling is altered.

**Procedure** Participants were run individually in a quiet room. Instructions were given in Indonesian for the Indonesian speakers and English for the English speakers. For each set of stimuli, participants were first shown a family picture to ensure that they understood that the triad that followed only involved the children. (For the Ritual sets, the experimenter explained that the family lives on some island and they held a ritual each year. Then the standard was shown without further description.) For each standard, participants were asked to verbally describe what they saw in the picture. After participants had seen and described all of the standards, they were given a short break (approximately 10 minutes) during which they were asked to solve a few simple puzzles. Then they were given a yes-no recognition task. The two variants for each standard were intermixed in semi-random order among the fillers. The three standards that the participants had actually seen were given at the end of the test.

## Results

As in the previous study, the key dependent measure is the mean proportion of times a participant responded ‘yes’ to each variant; i.e., the false alarm rates on the Gender

Variants vs. the Seniority Variants. An ANOVA over Language and Variant Type showed a main effect of Variant Type ( $F(1,26) = 7.21, p = .01$ ) such that participants made more seniority-preserving false alarms ( $M = .29$ ) than gender-preserving ones ( $M = .13$ ) and a main effect of language ( $F(1,26) = 6.61, p = .02$ ), such that Indonesian speakers made more false alarms ( $M = .29$ ) than English speakers ( $M = .12$ ). As predicted, there was a significant interaction between the two factors ( $F(1,26) = 4.90, p = .04$ ). Indonesian speakers made more false alarms to the Seniority Variants ( $M = .42, SD = .30$ ) than to the Gender Variants ( $M = .16, SD = .21$ ). English speakers showed no difference in false alarm rates (for Seniority Variants,  $M = .13, SD = .17$ , and for Gender Variants,  $M = .10, SD = .21$ ).

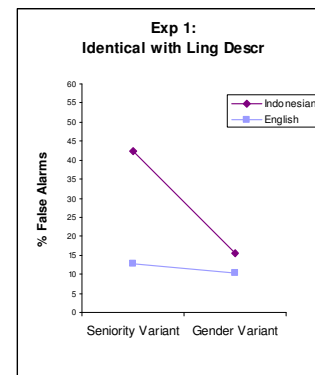


Figure 4: Results from Experiment 1.

## Discussion

When participants described scenes verbally, they showed sensitivity to the dimension ensconced in their language on a subsequent recognition test. That is, Indonesians were significantly more able to reject variants that changed seniority relations than those that preserved seniority but changed gender. The results are stronger than those of our previous study (described above), in which linguistic descriptions were not elicited prior to the memory task. This suggests a ‘thinking for speaking’ effect whereby giving a linguistic description strengthens the effects of language on the encoding of the scenes. Interestingly, in this study the interaction appears to be driven by the Indonesian pattern; the English speakers showed roughly equal false alarms. However, the relative difference between the two language groups is as predicted: Indonesian speakers attended more to seniority than did English speakers. This pattern fits with our prediction of greater relative sensitivity to the dimension required in naming siblings.

One methodological point to note is that the nature of the design is limited in terms of the possible variants that we could devise for a given standard. This resulted in the Gender Variant being more perceptually similar to the Standard than was the Seniority Variant. In order to get around this problem, in the next study we decided to alter the identity match between the families in the pictures by

using a different family altogether for the variants. Thus, the variants did not retain the perceptual aspects of the Standard but were still designed to be relationally similar to the standard along either the seniority or gender dimension (see Figure 5). These new variants always embodied the same relationships as the previous variants. Thus the new variants fell further along the *literal similarity – analogical similarity continuum* (Gentner, 1989) than the original ones.

The analogous variants were used in a recognition task like the one described in Experiment 1. The idea was to test the strength of participants’ “hold” of the relation and to see whether verbalization would influence the strength of the language effect. Of course, one might predict that participants would not false alarm at all to the analogous variants; after all, the variants depict different people altogether. On the other side, it seems possible that applying a linguistic description could invite a more abstract encoding, and that this could increase participants’ propensity to recognize the same relation in different characters.

Indonesian and English speakers were shown a series of pictures: the three kinship standards and their three corresponding family pictures from Experiment 1, along with 23 other pictures. Participants were asked to remember the scenes for a later memory task. Recognition memory for the scenes was later tested using analogically similar Gender and Seniority Variants.

## Experiment 2a

**Participants** Participants were 15 Indonesian monolinguals and 17 English monolinguals (not previously tested), ranging in age from approximately 17 to 20 years old. They were either given credit or a small monetary compensation. Data from Indonesian speakers were collected in Jakarta, Indonesia. Data from English speakers were collected at Northwestern University and other areas near Chicago.

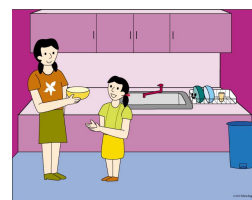
**Materials** There were 29 study pictures (the three standard pictures from Experiment 1, their three corresponding family pictures, and 23 filler pictures). There were 67 test pictures (the three standards and all six of their variants, plus 58 fillers, as described below).



Identical Family Pict.

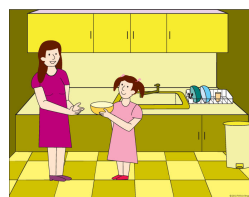


Analogous Family Pict.



Standard

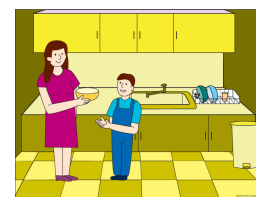
*older sister gives bowl to younger sister*



Analogous

Seniority Variant

*older sister gives bowl to younger brother*



Analogous

Gender Variant

*younger sister gives bowl to older sister*

Figure 5: The Kitchen set, showing analogous variants used in Experiment 2.

**Procedure** As in Experiment 1, before each standard picture, participants were shown a family picture to ensure that they understood that the picture that followed involved only the children. (For the Ritual sets, the experimenter explained that the family lives on some island and held a ritual each year. Then the standard was shown without further description.) Participants were simply asked to remember the pictures. Then they were given a short break (approximately 10 minutes) during which they were asked to complete an unrelated paper-and-pencil task. Then they were given a yes-no recognition task. The two analogous variants for each standard were intermixed in semi-random order among the fillers. The three standards were given at the end of the test.

## Results

An ANOVA over Language and Variant Type showed no significant main effects or interaction (all  $p$ 's > .1). Qualitatively, there was a weak tendency for Indonesian speakers to make more false alarms to the Seniority Variants ( $M = .36$ ,  $SD = .32$ ) than to the Gender Variants ( $M = .18$ ,  $SD = .28$ ). The English speakers showed little difference between the two conditions (Seniority Variants,  $M = .20$ ,  $SD = .31$ ; Gender Variants,  $M = .16$ ,  $SD = .27$ ).

## Experiment 2b

**Participants** Participants were 15 Indonesian monolinguals and 17 English monolinguals not previously tested, ranging in age from approximately 17 to 20 years old. They were either given credit or a small monetary compensation. Data from Indonesian speakers were collected in Jakarta, Indonesia. Data from English speakers were collected at Northwestern University and other areas near Chicago.



**Materials** Same as Experiment 2a.

**Procedure** Similar to Experiment 2b. The only difference is that during the study phase, participants were asked to verbally describe each scene, much like in Experiment 1.

## Results

An ANOVA over Language and Variant Type revealed no significant main effects (all  $p$ 's  $>.1$ ). As predicted, the ANOVA showed a significant interaction between the two factors ( $F(1,30) = 5.16, p = .03$ ). There was a tendency for Indonesian speakers to make more false alarms to the Seniority Variants ( $M = .18, SD = .28$ ) than to the Gender Variants ( $M = .11, SD = .21$ ). The English speakers showed the reverse pattern; they made more false alarms to the Gender Variants ( $M = .33, SD = .24$ ) than to the Seniority Variants ( $M = .16, SD = .21$ ).

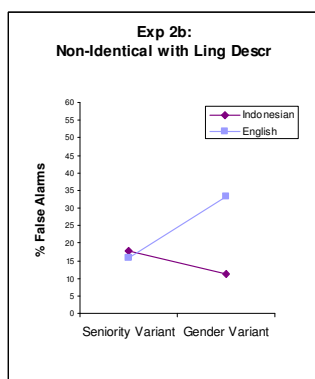


Figure 6: Results from Experiment 2b.

## Discussion

The results from Experiment 2 suggest that for this more challenging task, cross-linguistic effects on encoding and recognition was only evident when participants were asked to verbally describe the scenes. In Experiment 2a, the effects of semantic categories on recognition seemed to be “masked” by the more challenging non-identical transfer task. When participants described the scenes verbally, however, as in Experiment 2b, this effect resurfaced. The pattern from the previous study was also found here: Indonesian speakers showed greater relative sensitivity to changes in seniority than to changes in gender in recognition memory, whereas English speakers showed the reverse pattern, as evidenced by the marginally significant interaction between language and variant type. As in Experiment 1, this pattern suggests greater sensitivity to the dimension that is required in naming siblings in each language.

Overall, we find a pattern of stronger results when people gave verbal descriptions of the scenes. Their descriptions, which typically included kinship terms, seem to heighten effects of language on encoding and memory. Using the identical family variants, the interaction between language

and variant type (which was only marginal in our previous study) was significant in Experiment 1. Using the analogous variants (Experiment 2), the interaction between language and variant type was only significant when participants were instructed to use linguistic description. Our overall results suggest that the difference in the semantic patterns of the two languages may lead to differences in the way speakers encode situations – even nonlinguistic perceptual scenes. These results are consistent with the *thinking for speaking* idea in that actively using a language influences encoding and recognition memory.

Our thinking-for-speaking pattern of result is consistent with previous research showing that cross-linguistic differences influence judgments of spatial pictures (Gentner & Feist, submitted) and motion events (Malt, Sloman, & Gennari, 2003), but only when participants were asked to use linguistic description. However, it is also important to note that some studies have shown effects of cross-linguistic semantic differences on nonlinguistic performance without asking participants to first verbalize the scenes (e.g., Boroditsky, Ham, & Ramscar, 2002; Levinson et al., 2002). Indeed, in our own previous studies in this arena, we found cross-linguistic effects in similarity judgments and word extension without the use of verbalization. The similarity task was a simple triad judgment task and the word extension task was a novel name given to a standard picture and participants were asked to extend the novel name. In neither case were participants asked to describe the scenes themselves (Anggoro & Gentner, 2003). Interestingly, a comparison of the present results with our prior results (in which no verbal descriptions were elicited) (Anggoro & Gentner, 2003) suggests that in some cases, the predicted pattern are qualitatively stronger when prior verbalizations are elicited.

## General Discussion

In conclusion, our findings suggest that linguistic differences in kinship terms (specifically, sibling terms) influence the way people encode and remember scenes and perceive similarities among them. Overall our results suggest that the actual verbalization of these semantic distinctions strengthens the cross-linguistic effects. Since in our previous work, cross-linguistic effects were found with or without linguistic description, the most intriguing aspect of our current findings is that this influence of verbalization appears stronger when the variants were *non-identical* to the standard<sup>1</sup>. The use of language may be particularly important in cases where the bridge between initial encoding and later experience is somewhat more abstract. Gentner (2003) has suggested that one role of language in

<sup>1</sup> Cross-experiment analyses of recognition results comparing participants who had initially given linguistic description of the scenes with those who had not (Anggoro & Gentner, 2003) showed a stronger pattern in the predicted direction for analogous pairs, especially among English speakers.

cognition is to facilitate memory access between situations that are not superficially similar but can be categorized in similar ways, as in the case of relational meanings.

Thus, our findings may provide a link between work in language and thought with work on analogical processing. Finally, our findings provide evidence that the use of language can influence encoding not only in spatial domains but also in the social arena.

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