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Are we *ON* the same page? Monolingual and bilingual acquisition of familiar and novel relational language

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Abstract

Verbs and prepositions pose significant challenges in second language learning, as languages differ in how they map these relational terms onto events. Second language learners must put aside their language-specific lens to uncover how a new language operates, perhaps having to rediscover semantic distinctions typically ignored in the first language. The current study examines how the acquisition of these novel mappings are affected by characteristics of the learner and of the language to be learned. English monolinguals and Dutch-English bilinguals learned novel terms that corresponded to containment and support relations of either English, Dutch, or Japanese. Results show that English distinctions are learned best across groups, potentially reflecting predispositions in human cognition. No differences were found between monolinguals and bilinguals in any language condition. The characteristics of the language to be learned appear to play a prominent role in the acquisition of novel semantic categories.

Keywords: Cognitive Semantics; Second Language Learning; Bilingualism; Event Perception

Introduction

Verbs and prepositions are fundamental components of language, conveying dynamic and static relations between objects in events (e.g., “He *kicked* the ball *over* the fence”). Despite their centrality, these relational terms prove challenging for both first and second language learners (Gentner, 2006). Part of the challenge arises from the fact that languages differ in the aspects of events they emphasize. For example, while English utilizes *in* and *on* to denote containment and support relations, respectively, other languages vary in terms of the granularity or foci of these distinctions (Gentner & Bowerman, 2009). Dutch makes finer-grained divisions, breaking support into three distinct categories: *op* (i.e., resting on), *aan* (i.e., point-to-point attachment), and *om* (i.e., encirclement with contact). In contrast, Japanese verbs require attending to degree-of-fit

relations, sometimes in conjunction with the *in/on* distinction, as in *oku* (i.e., loose-fitting on) and *ireru* (i.e., loose-fitting in), but sometimes collapsing across it, as in *hameru* (i.e., tight-fitting on or in; see Figure 1). How do learners come to discern these categories in language?

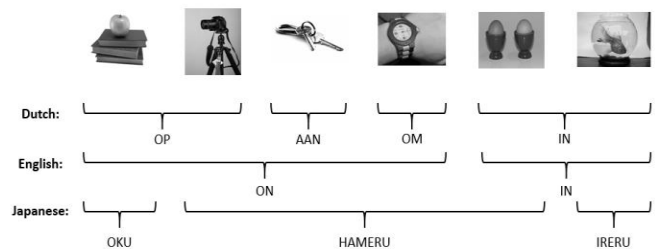


Figure 1: Containment and support in Dutch, English, and Japanese, inspired by Gentner and Bowerman (2009).

Over the first year and a half of life, infants learn to attend to a set of foundational components of events that support the structure of semantic categories across a wide array of languages (e.g., George, Göksun, Hirsh-Pasek, & Golinkoff, 2014; Göksun, Hirsh-Pasek, & Golinkoff, 2010; McDonough, Choi, & Mandler, 2003). With exposure to language, however, infants appear to focus on a subset of categories relevant to their native tongue. Language, in other words, has the function of orienting attention to some relations in events over others (George, et al., 2014; Göksun, et al., 2010). Heightening and dampening attention to early perceptual categories creates entrenched *lexicalization biases*, or strategies for word-to-world mapping. These biases are largely believed to influence event perception in children and adults, though there remains debate regarding the scope of these effects (e.g., Choi & Hattstrup, 2012; George et al., 2014; Gleitman & Papafragou, 2013; McDonough et al., 2003; Papafragou, Hulbert, & Trueswell, 2008).

Bilingualism and Second Language Learning

The study of first language acquisition suggests that lexicalization biases affect the way in which adults process events for language. While beneficial for mapping language onto relations in events, lexicalization biases also potentially bear on challenges in second language learning. Learning a new language requires second language learners (SLLs) to not only acquire a new lexicon, but to identify how relational terms in the second language map onto events. Given that the overlap in the lexicalization patterns between languages is unknown, SLLs must be able to put aside their language-specific lens to uncover the way the new language operates, perhaps having to resurrect semantic distinctions typically ignored in the first language.

Research examining the endpoint of second language learning highlights plasticity in these biases. Hohenstein, Eisenberg, and Naigles (2006) found that even college students who did not begin second language instruction until after puberty can achieve native-like lexicalization biases in their second language. This process takes time, however. Song, Pulverman, Pepe, Golinkoff, and Hirsh-Pasek (2016) found that approximately seven semester-long courses are required to elicit lexicalization biases in a second language that do not differ from native speakers. Artificial language experiments suggest a higher degree of malleability. Havasi and Snedeker (2004) taught English-speaking adults nonsense verbs in English consistent with the Spanish bias to encode path in the main verb (e.g., crossing). At the beginning of the experiment, subjects preferred applying the novel verb to manner of motion, according with the English bias. As the experiment progressed, participants shifted towards a path interpretation for novel verbs, suggesting these biases can be changed with relatively short exposures.

While these biases are malleable, there remains a relatively impoverished understanding of the factors that contribute to the successful learning of novel semantic spaces. Most research in this area focuses on the added benefit of immersion over traditional classroom instruction (e.g., Song, et al., 2016). In the parallel field of phonetic learning, however, research suggests that learning features of a new language can be attributed to an amalgam of characteristics both of the learner and of the material to be learned (Antoniou, Liang, Ettliger, & Wong, 2015). Here we investigate the impact of three features on the malleability of lexicalization biases: 1) the difficulty of the contrasts to be learned; 2) the degree of similarity between languages; and 3) bilingualism.

Ease of acquisition may be attributable in part to the characteristics of the language to be learned. Some lexicalization patterns may be easier to acquire, regardless of their relation to the learner's native tongue. Returning to work on development, Gentner and Bowerman (2009) note that the semantic categories underlying relational language emerge at different points across development. In their *Typological Prevalence Hypothesis*, they suggest that more cross-linguistically prevalent categories are more "natural" in perception and thus easier to learn. For instance, the

English support category of *on* is more prevalent across languages than the Dutch category of *aan*, and correspondingly emerges earlier in English-speaking children's vocabulary than does *aan* in Dutch-speaking children's vocabulary (see also Beekhuizen, Fazly, & Stevenson, 2014). Extending this hypothesis to the study of second language learning, those categories that are more universal may also be those that are easier to rediscover regardless of the learner's native language.

The ease in acquiring a new language may also be proportional to the degree of similarity between that language and the language(s) known by the learner (e.g., Antoniou, et al., 2015). In the domain of containment and support, for example, we might expect that a monolingual English speaker would more easily acquire a novel language that shares the *in/on* distinction, when compared to a language such as Japanese, which sometimes requires collapsing across it. In this regard, we see a potential language-dependent advantage for bilingual speakers: using two languages with potentially disparate lexicalization patterns increases the likelihood that at least one of these will be reflected in any newly encountered language.

Finally, research on second language learning suggests that bilinguals acquire novel languages more efficiently than monolinguals overall (e.g., Kaushanskaya & Marian, 2009; Van Hell & Mahn, 1997). A common explanation regards bilingual advantages in several areas of cognition, including those associated with executive control (e.g., inhibition, working memory, etc.) among others (Bialystok, Craik, & Luk, 2012). These cognitive skills may lead to a more efficient restructuring of lexicalization biases. For example, inhibitory control may assist in the dampening of native biases when interpreting novel patterns.

The Current Study

The current study seeks to deepen our understanding of the factors underlying the successful learning of novel lexicalization patterns. We examine the ability of English monolinguals and Dutch-English bilinguals to learn novel terms that map onto either the English, Dutch, or Japanese semantic categories of containment and support. We make several hypotheses. First, if cognitive predispositions favor some lexicalization patterns over others irrespective of language experience, we would expect that both monolinguals and bilinguals would show the same patterns of learning, with the categories more central to cognition being learned more efficiently than those less prevalent. This pattern may be observed on the level of language (e.g., English more central than Japanese) or individual category (e.g., Dutch *in* more central than *aan*). Alternatively, if ease of acquisition is dependent upon the relation between the lexicalization patterns of language to be learned and those known by the learner, we would expect that monolinguals and bilinguals would perform equally well in acquiring the semantic categories of English (known by both) and equally poorly in acquiring the semantic categories of Japanese (known by neither), but that bilinguals would outperform

monolinguals in acquiring the semantic categories of Dutch (known only to bilinguals). We also expect variations of this pattern on the category level, reflecting differences in the degree of overlap between English and Dutch categories. For example, bilinguals should not outperform monolinguals in acquiring the Dutch category *in*, which is shared across English and Dutch. Finally, if there is a more general bilingual advantage in learning new lexicalization patterns, bilinguals should outperform monolinguals overall, even when learning Japanese, a language with which they have no experience.

Methods

Participants

One-hundred and six monolingual English-speaking adults were randomly assigned to one of three conditions of a word learning task: English mappings (N= 33, M = 18.76 yrs; 4 Male), Dutch mappings (N= 37, M = 19.69 yrs; 5 Male), or Japanese mappings (N= 36, M = 18.97 yrs; 3 Male). All participants' self-rated proficiency in a second language was five or less on a ten-point scale. An additional 41 participants were excluded from the current analyses due to bilingual status. Further, an additional six were excluded altogether for inattention (4) and technical error (2).

Fifty-four Dutch-English bilinguals living in the Netherlands were also randomly assigned to the English (M = 23.89 yrs; 6 Male), Dutch (M = 24.83 yrs; 7 Male), and Japanese (M = 22.89 yrs; 2 Male) conditions (18 in each). All bilingual participants' self-rated proficiency in English was six or higher on a ten-point scale. Two additional bilinguals were excluded for failure to understand the task.

Materials

For each condition, images were selected to represent four distinct semantic categories. In the English condition, these consisted of the two English containment/support categories (*on*, *in*) as well as two filler spatial relations (*beside*, *behind*) that are similar across the languages used in the experiment. In the Dutch condition, the semantic categories were made up of the four Dutch containment/support categories of *op* (resting on), *aan* (attachment), *om* (encirclement with contact), and *in*. In the Japanese condition, these categories corresponded to three Japanese containment/support categories of *oku* (loose-fitting on), *ireru* (loose-fitting in), and *hameru* (tight-fitting on/in) as well as one filler category that is similar across languages (*behind*). For each relation in each condition, 32 distinct images were chosen from the public domain (128 in total per condition). The assignment of images to their semantic categories was done in consultation with a native speaker for all conditions.

For each image, a recording was made that presented a novel word embedded within a syntactic frame. The use of syntactic frames allowed for the disambiguation of the meaning of the terms. For example, when viewing an apple resting on a pile of books, the recording might state, "The apple is *blick* the books." For each image, four sentences

were recorded by a female native English speaker, each utilizing a different nonce word (*blick*, *frep*, *glorp*, *hirsh*).

A language history questionnaire (LHQ) assessed language proficiency (Li, Sepanski, & Zhao, 2006). The LHQ asks participants to self-rate their proficiency in each known language, among other aspects of language use.

Procedure

Participants were tested in a quiet room equipped with a computer and headphones. In all conditions, the experiment consisted of eight blocks. Each block consisted of eight training trials followed by eight test trials.

Training Each training trial presented an auditory sentence (e.g., "The ring is *blick* her finger") paired with a picture depicting the relation referenced. Within each block, eight trials were presented in succession, two for each of the condition's four categories. Each trial lasted five seconds and trials proceeded in a random order.

Test Each test trial presented a novel picture paired with a four-alternative multiple choice question. Questions required subjects to choose a word to fill in a sentence, mirroring the structure of the recorded sentences used during training with the blank corresponding to the position of the nonce word (see Figure 2). Answers consisted of the target word, plus the three remaining nonce words presented during the training phase. Within each block, eight trials were presented in succession, with two trials per category in the condition. Trials were untimed and randomized.

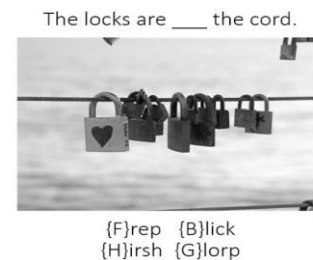


Figure 2: Example of a test trial.

Design No images were repeated during the experiment, ensuring responses to test trials were based on knowledge of the semantic category and not memory for word-image pairings. The assignment of images to training or test trials, as well as the mapping of nonce words to semantic categories were counterbalanced within each condition. Following the experiment, participants completed the LHQ.

Instructions were presented in the participant's native language; however, recordings and test sentences were presented in English for all participants.

Results

A series of ANOVAs were conducted. For all ANOVAs, the Greenhouse-Geisser correction was applied whenever sphericity was violated (Greenhouse & Geisser, 1959).

First, we conducted an ANOVA examining accuracy scores, with block as a within-subjects factor, and condition (English, Dutch, Japanese) and language background

(monolingual, bilingual) as between-subjects factors. Results showed a main effect of block (see Figure 3), reflecting improved mapping of words to referents across the experiment, $F(4.687, 745.710) = 150.839, p < .001$.

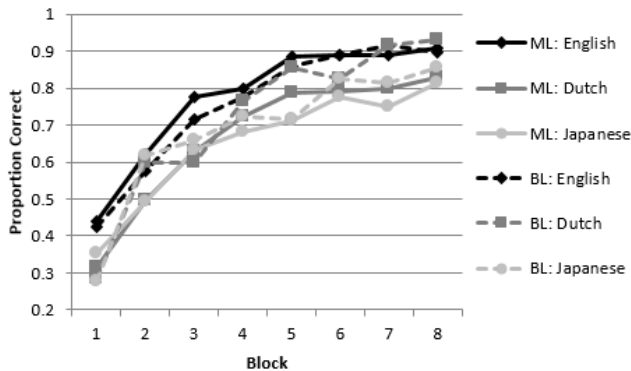


Figure 3: Learning by language background (monolingual vs. bilingual; ML and BL, respectively) and condition (English vs. Dutch vs. Japanese).

Further, there was a significant effect of condition, $F(2, 154) = 3.863, p < .05$. Bonferroni-corrected ($p < .017$) post-hoc contrasts suggested that English categories were learned significantly better than Japanese categories, $t(103) = 3.057, p < .017$. English categories were also learned better than Dutch categories, though this result was only marginally significant, $t(104) = 2.246, p = .027$. There was no difference between participants in mapping Dutch and Japanese categories, $t(107) = .899, p = .371$ (see Figure 4).

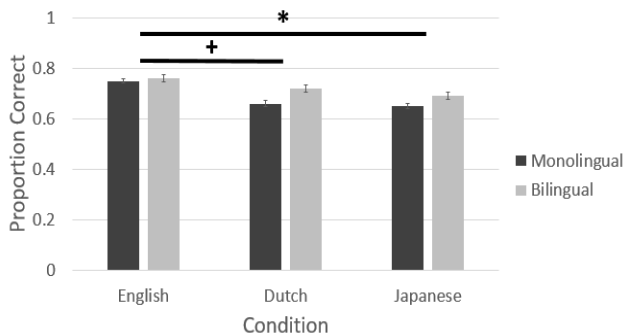


Figure 4: Proportion of correct responses by condition and language background. * $p < .017$ + $p < .034$

There was no effect of language background, nor any interactions between block, condition, and language background, $ps > .05$. Thus, bilinguals did not show any advantage overall, nor within any language condition.

Because some categories are similar across languages (e.g., *in*), we next looked for differences on the level of categories, to determine whether certain semantic distinctions were driving the observed condition differences. For each condition, an ANOVA was conducted, with both category and block as within-subjects factors, and language background as a between-subjects factor (Figure 5).

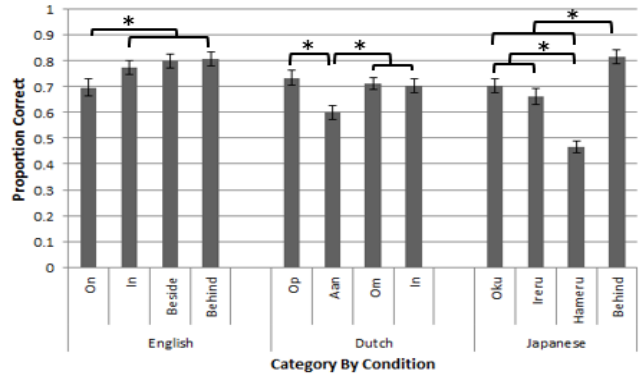


Figure 5: Proportion of correct responses broken down by condition and category. * $p < .008$

For the English condition, there was a significant main effect of block, $F(3.254, 162.750) = 45.535, p < .001$, and category, $F(3, 350) = 11.756, p < .001$. Bonferroni-corrected ($p < .008$) post-hoc contrasts were conducted to examine how learning differed among the categories. Participants performed worse on the category of *on* in comparison to *in*, $t(50) = 3.418, p < .01$, *beside*, $t(50) = 5.071, p < .001$, and *behind*, $t(50) = 5.360, p < .001$. Performance on all other categories was equivalent, $ps > .008$.

For the Dutch condition, there was a significant main effect of block, $F(4.839, 261.198) = 65.142, p < .001$, and category, $F(3, 378) = 10.475, p < .001$. Bonferroni-corrected ($p < .008$) post-hoc contrasts were conducted to examine how learning differed among the categories. Participants performed worse on the category of *aan* in comparison to *op*, $t(54) = 5.054, p < .001$, *om*, $t(54) = 5.180, p < .001$, and *in*, $t(54) = 4.365, p < .001$. Performance on all other categories was equivalent, $ps > .008$.

For the Japanese condition, there was a significant main effect of block, $F(4.804, 254.506) = 43.745, p < .001$, and category, $F(3, 371) = 49.386, p < .001$. Bonferroni-corrected ($p < .008$) post-hoc contrasts were conducted to examine how learning differed among the categories. Participants performed worse on *hameru* compared to *oku*, $t(53) = 8.370, p < .001$, *ieru*, $t(53) = 6.399, p < .001$, and *behind*, $t(53) = 12.983, p < .001$. Participants also performed worse on *oku* and *ieru* when compared to *behind*, $t(53) = 4.619, p < .001$ and $t(53) = 5.569, p < .001$, respectively. There was no difference between *oku* and *ieru*, $p > .008$.

Neither language background, nor any interactions between block, category, and language background were significant in any condition, $ps > .05$.

Discussion

Lexicalization biases present a challenge for learning a new language. To achieve native-like competency, learners must potentially put aside these longstanding biases to discover how a new language maps relational terms onto relations in events. Our results provide evidence that some lexicalization patterns may be easier to learn than others, a factor that has been found to impact other facets of second language acquisition (e.g., Antoniou, et al., 2015). Japanese

and to a lesser extent Dutch biases proved more difficult to learn than English biases. This finding is particularly striking given that both Dutch and Japanese conditions included categories native to English (e.g., *in* for Dutch, *behind* for Japanese) that may have inflated performance. Further, the bias for English lexicalization patterns is apparent on the level of individual categories. Categories most difficult to learn were those most typologically dissimilar from English. For instance, post-experiment debriefings suggest that monolinguals could rely on rough English equivalents to support learning *op* (prototypical *on*), and *om* (*around*) in Dutch, but that this strategy was less productive for *aan* (attached, hanging, on, etc.). Similarly, participants could simplify the categories of *oku* and *ireru* in Japanese to prototypical containment and support relations, whereas *hameru* had no clear English equivalent.

Interestingly, both monolinguals and bilinguals showed the same enhancement of learning English patterns over Dutch and Japanese, even though the native language of the bilingual group was Dutch. This pattern of results may support the notion that cognition is predisposed to attend to the categories of some languages more than others, an experience-independent effect that is immune to the language background of the learners tested in our study (though see below for an alternative explanation). As discussed by Gentner and Bowerman (2009), English containment and support categories are more universally represented across languages and appear early in children's vocabularies, reflecting their potential centrality to cognition. We mirror this pattern in the learning of additional languages. Thus, the superior learning of the English biases may be further reflection of the centrality of the *in/on* distinction, relative to the semantic categories of Dutch or Japanese. Our results are also in accord with recent work on action words, in which cognitive predispositions for encoding path information, but not adults' language backgrounds, predicted the ease with which they learned novel words (Emerson, Özçalışkan, & Frishkoff, 2016).

Bilingual Advantage?

While the results support experience-independent effects of the language to be learned, we find no evidence of additional experience-dependent effects. Dutch-English bilinguals did not outperform English monolingual speakers when learning the semantic categories of Dutch, a language with which monolingual participants had no prior experience. This result also holds on the level of individual categories, with Dutch-English bilinguals not outperforming English-speaking monolinguals on any Dutch category.

The lack of facilitative effect for Dutch-English bilinguals in learning Dutch lexicalization patterns is a departure from related research in phonology. Antoniou and colleagues (2015) found that English monolinguals, Mandarin-English bilinguals, and Korean-English bilinguals all learned novel words better when the words relied on Mandarin, as opposed to Korean phonetic contrasts, analogous to the cognitive predisposition for English categories here. Unlike

the current results, however, there was also a language-dependent effect: Korean-English bilinguals outperformed the other groups on words that relied on Korean contrasts. Why might the results here be different? The lack of advantage may be due in part to the higher malleability of lexicalization biases. The phonetic space is drastically restructured over the course of development (Werker & Tees, 1984) and even advanced SLLs struggle to discern non-native phonetic contrasts (Pallier, Colomé, & Sebastián-Gallés, 2001). The heightening and dampening of lexicalization biases, however, is thought to be less dramatic, with non-native categories easily re-awakened in certain contexts (Choi & Hatrup, 2012).

We also found no evidence of a general bilingual advantage, again in contrast to research in other areas of second language learning (Antoniou, et al., 2015; Kaushanskaya & Marian, 2009; Van Hell & Mahn, 1997). Specifically, bilinguals were no better at mapping relational terms than monolinguals across both familiar and novel lexicalization patterns. Future research will examine performance relative to traditional measures of executive function to isolate whether these variables thought to underlie bilingual advantages in language learning are relevant to the learning of lexicalization patterns.

Limitations and Future Directions

When considering how language experience affects the learning of lexicalization patterns, there is another factor that must be considered: context. Despite written instructions in Dutch, the presentation of the experiment by an English-speaking experimenter and the use of English to frame nonce words may have biased bilinguals away from the lexicalization patterns of their native Dutch and towards those of their second language, English. Indeed, in research on motion conceptualization, Spanish-English bilinguals attend more to manner of motion when tested in English, which prominently marks this aspect of events, as opposed to Spanish, which does not (Kersten, et al., 2010). Future conditions will manipulate the language of presentation to determine whether the pattern of results in the current study is caused in part by a predominantly English context.

Further, while the patterns observed are consistent with a cognitive predisposition account, other variables warrant consideration. For instance, the pattern of performance may be attributable to a preference for English's semantically broader categories, which may not always be a feature of categories proposed to be cognitively central. In addition, the use of fillers, such as *behind* and *beside*, may have differentially helped participants in the English and Japanese conditions, as distinctions between these relations and those of containment and support may be more obvious than distinctions within containment and support relations.

Finally, a particularly promising avenue for future research is the use of this paradigm with native speakers of Japanese. The results suggest that Japanese is the most difficult of the three lexicalization patterns tested. If this is an experience-independent effect due to cognitive

predispositions, we would expect even Japanese speakers to show poorer learning of these categories relative to those of English and Dutch in an artificial language learning task.

Conclusion

Lexicalization biases provide a lens with which to process events for language. When learning a novel language, however, these biases must be put aside in favor of new ways of representing relations in events. The current study suggests that a primary influence on this process may be the extent to which cognitive predispositions align with the lexicalization patterns of a new language.

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