日本人英語学習者の空間認知再構築における分析

Does language restructure spatial cognition?
A case of Japanese university students

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Abstract

The present study examined the influence of second language (L2) on the spatial categorization of Japanese university students. Focusing on three spatial relations - containment, support and degree-of-fit - the issues of how Japanese speakers classify spatial relations and how L2 (English) affects their cognition were investigated. All participants were administered with 15 trials of the judgement task. The results revealed three findings. Firstly, Japanese speakers have an inclination to categorize space with degree-of-fit relations. Secondly, the spatial categorization preference patterns of Japanese speakers slightly shifted to that of English speakers. Thirdly, it is positive that as language proficiency increases, the degrees of influence become conspicuous. The implication of these findings suggests that concepts in the human mind are flexible, changing and susceptible to both linguistic and cultural influence.

1. Introduction

It is said that there are over 7,000 languages spoken in the world today. Ostensibly bilingualism is a rare phenomenon; however, the number of bilinguals is multiplying rapidly and the volume of bilinguals is conjectured to outnumber monolinguals. Grosjean (2010) mentioned that the United States is estimated to have as many as 50 million bilinguals. Many schools, teachers, parents and governments all

over the world, including Japan, attempt to raise their children as bilinguals from infancy. The Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) announced a plan to reform English education aiming at globalization in 2013. The plan introduces English language activities to third and fourth grade children and sets the English curriculum from higher grades at elementary school. The substantial instruction to construct students' identities as Japanese is equally necessary alongside new English educational reform. Accordingly, the expansion of the bilingual population will be inevitable in time to come.

1.1 Multi-competence hypothesis

In the field of second language acquisition (SLA) and bilingualism, exploring mechanisms for how L1 and L2 interact with each other or how bilinguals control two or more language systems have become significant topics as the number of bilinguals expands. In an innovative research study focusing on cognitive change by L2, Cook (1991) firstly announced the concept of multi-competence (MC). Cook (2016) recently defined MC as 'the overall system of a mind or a community that uses more than one language' (p. 3). MC hypothesis proposes cross-linguistic influence on language schemes, such as lexicons, phonological systems, pragmatic patterns, syntactic processes and cognition, not only from L1 to L2 but also some effects from L2 to L1. To emphasize the MC hypothesis, it has been frequently investigated from various angles how acquiring L2 affects psychological organization.

Using the methodology of Imai and Gentner (1997), Cook et al. (2006) measured the effects on Japanese speakers' categorization of objects and substances in the process of learning English as L2 to strengthen the claim that L2 users have different cognitive processing from monolinguals. In their experiment, a target item such as a cork pyramid with a nonsense word such as ejulem was presented and then participants were asked to choose which item most matched it: one with the same shape (a plastic pyramid) and the other with the same material (a piece of cork). Participants were divided into two groups: those who had lived in an English speaking country for six months to within three years were included in a short-stay group, and those in a long-stay group who had lived in an English speaking country for three years or more. The results indicated that although

both groups preferred material responses, the long-stay group showed more shape preference than the short-stay group. That is to say that the categorization of the long-stay group was different from that of monolingual speakers.

In previous multi-competence studies, however, bilinguals who live or stay in a country where their target language (L2) is spoken as a L1 are subject to experiments. For the purpose of exploring the effects of early stage second language acquisition, Murahata (2010) conducted a cross-linguistic investigation of Japanese children. The participants, 76 children from 10 to 11 years of age, were divided into three groups in accordance with the quantity of their exposure to English. Building on a study by Ji et al. (2002), each subject was first shown a picture of an object such as a cow or monkey. After this, they were given two more pictures, one related categorically and the other related thematically, and they were required to point immediately at which they thought best matched with the first one. This study established three significant findings. Firstly, Japanese monolinguals preferred thematic matches. Secondly, as L2 exposure increased, L2 users shifted their matching preferences from thematic to categorical. Thirdly, the response time of L2 users who had more contact with L2 was faster than L2 users whose L2 exposure was less.

Dewaele (2016) argued that 'while the multi-competence perspective focuses on the effect of the new language rather than the new culture on the mind of the speaker, it is in fact quite difficult to separate these two entwined variables' (p. 463). This is in agreement with Cook's claim that language cannot be separated from the rest of the mind or the community, but rather that it influences the cognitive dispositions of L2 users, including cultural and social aspects. Remarkably, the results of Murahata (2010), however, showed that L2 users who have never stayed in an L2-speaking country still shifted their dispositions and that the shift was greater with greater English exposure. Boroditsky (2001) also found that English monolingual speakers who were instructed to talk about time using vertical terms in the short term were recorded showing identically similar results with Mandarin monolingual speakers. These imply that second language acquisition alone influences an L2 user's mind in some way.

1.2 Spatial concepts across languages

differ across languages. In a traditional study, Haviland (1993) examined contrasted frame of reference distinctions with English speakers and speakers of Guugu Yimithirr (Australia). He found that while speakers of Guugu Yimithirr use only an absolute frame of reference, English speakers use two different frames of reference – a relative one and an intrinsic one - to describe spatial relationships.

Distinctions between spatial categorizations, especially preposition terms such as in, on and above, across languages has also been a controversial topic in linguistic studies. Bowerman (1996) examined a cross-linguistic comparison on spatial categorization, namely containment, support and attachment, in four languages (English, Finnish, Dutch and Spanish) and depicted spatial relations among the languages. English applies in to containment and on contrarily represents both support and attachment, but Finnish applies the inessive suffix –ssa to containment and attachment, in contrast to the adessive suffix –lla which articulates a support relation. Spanish uses the same preposition en for all three spatial relations, while Dutch uses three different prepositions for each spatial concept: in for containment, op for support and aan for attachment.

Choi & Bowerman (1991) argued that Korean does not have a word which has the same meaning as in in English. The word in used by English speakers includes a containment aspect but not a tight-fit relation. That is to say (put) in can be identically used for both putting an object into a loose container and fitting an object into a tight container. In Korean, the word kkita expresses "put something into a tight-fitting/ interlocking relationship with something else" (Choi et al. 1999, p. 242). In short, kkita encodes a tight-fit relation, but not the containment aspect. Although English speakers lexicalize the distinction between containment relation (in) and support relation (on) disregard for degree-of-fit, Korean speakers phrase the distinction of degree-of-fit such as tight-fit (kkita) and loose-fit (nehta) but do not consider containment and support.

Choi et al. (1999) investigated young children's understanding of spatial terms (in vs. kkita) in English and Korean to explore the timing of sensitivity to language-specific categories. They found that even 18- to 23-month-old children gazed at the language appropriate matching scene more when they heard their target word in their language rather than when they did not hear the target word. The results suggested that

children associate spatial words such as in or kkita with language-specific semantic categories from as early as 18 to 23 months old.

To support the hypothesis that concerns linguistic relativity in spatial cognition, McDonough et al. (2003) examined the concept of containment, support and degree-of-fit with English and Korean-speaking 9- to 14-month-old infants and adults. One significant finding of their experiment was that participants - around 9 months of age - are responsive to the differences between tight and loose containment in either language but become less salient after English speakers learn their semantic systems.

Yet, there is a question of whether it is possible to compare in, which is a preposition, to kkita, which is a transitive verb. Choi & Bowerman (1991) insist that they can still sensibly be compared. According to Talmy (1985), languages are systematically different in how they break up the elements of motion events and allocate them to different components of a clause. In English, while information about the spatial relationship between a moving object and a reference point object (path) is typically encoded by particles or prepositions, the main verb expresses the fact of motion combined with information about the manner of the motion. In contrast to English, however, the semantic property of particles and prepositions in comparable words such as in, on and above in English is missing in Korean, along with Hebrew, Japanese and other languages, with the consequence that the verb characterizes both the path and the fact of motion (Choi et al., 1999).

As mentioned above, there has been much debate in relation to when the spatial language maps non-linguistic spatial concepts in the process of learning L1. Even if spatial knowledge might be structured once, there is a strong view that languages repeatedly narrow or sharpen up non-linguistic spatial distinctions. In the current paper, it is hypothesized that the Japanese spatial words hameru and ireru could be equivalent to kkita (tight-fit) and nehta (loose-fit) in Korean and also L1-influenced categorization preferences could again be modified by exposure to another language. For example, Japanese users of English classify spatial relations in a way that matches the English categorization preference more as their L2 proficiency becomes a higher level.

2. Method

2.1 Participants

Participants of the present study were 15 Japanese native speakers who are Japanese university students. The average age was 22, ranging from 20 to 23, and there were eight males and seven females. They were tested using the Oxford Placement Test to measure their proficiency of English and divided into two groups: a higher-score group who obtained a score of more than 30 (n = 7, four females, three males) and a lower-score group whose scores were under 30 (n = 8, two females, six males).

2.2 The task

The judgement task of the present experiment is based on Choi & Hattrup (2012). For each trial, the target video depicted an actor performing a particular spatial relation, for example, the action putting something in a container and after five seconds of a blank screen, two choices for a particular spatial relation that the actor also performed were shown on the screen side by side. Between the choice video and the next target video, there are five seconds of a blank screen. Four types of spatial relations were tested: (1) tight containment (tight-in); (2) loose containment (loose-in); (3) tight support (tight-on); and (4) loose support (loose-on). There were 12 trials and one practice trial.

Table 1

Examples of target and choice scenes

Target Scenes	
Tight-IN :	keys in locks; sticks in matching holes; books into their covers.
Loose-IN :	puzzle pieces in boxes; plastic shapes in a container.
Tight-ON :	plastic paperclips on paper; rings on fingers; Lego bricks on a Lego baseboard.
Loose-ON :	crayons on paper; wooden toy rings on a flat wooden block.
Choice Scenes	
tight-in :	puzzle pieces in slots; crayons into their case; Legomen in Lego cars.
loose-in :	books in a paper bag; toys in a basket; pencils in a cup.
tight-on :	pentops on pen; lids on plastic bottles; pencil erasers on pencil ends.
loose-on :	teacups on a table; books on books; wooden blocks on blocks.

2.3 Procedure

First, the participants filled out personal questionnaires and took the English proficiency test for 30 minutes. Each participant was tested individually in a quiet room. An experimenter instructed the participants to see a target video and furthermore to see two more videos similar to the target in some aspects. Then, they were asked to decide intuitively which video was more similar to the target and to tell an experimenter which one they chose. The choices were recorded by an experimenter. Before starting the video test, a practice trial was conducted to confirm if the participants understood the task exactly.
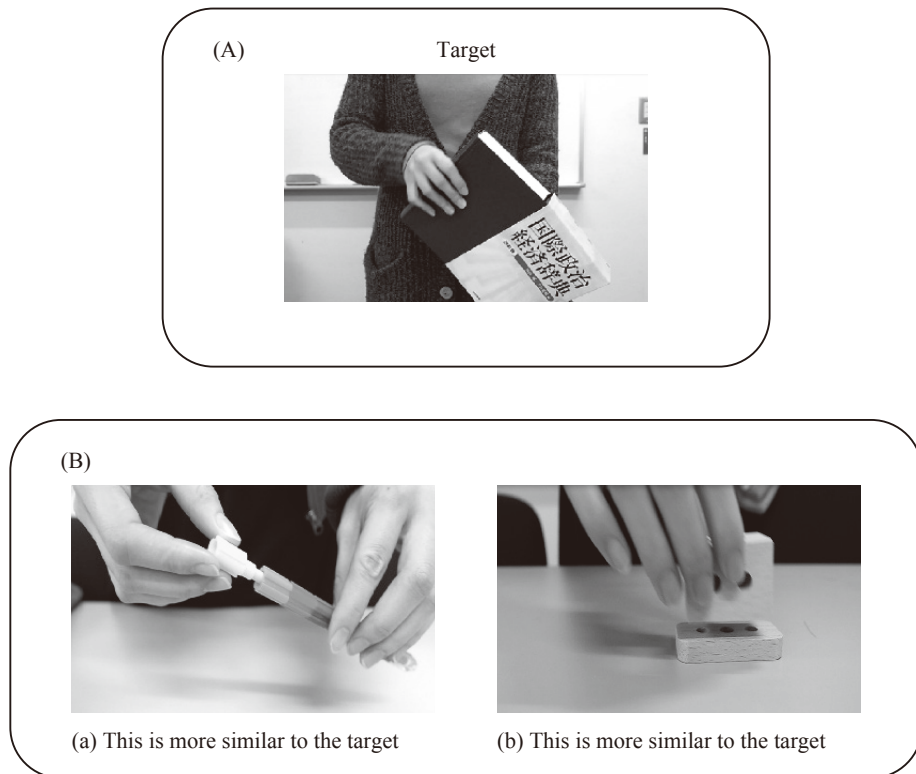
(A)   Target

(B)

(a) This is more similar to the target   (b) This is more similar to the target

Figure 1. (A) A target video. (B) A pair of choice videos with a question message below each video.

4. Results

In the present experiment, the participants had 12 trials to judge their preferences for all. Four trials were corresponded for each preference and the other four trials were matched with both. Figure 2 shows the mean of containment and support preference or degree-of-fit preference response.
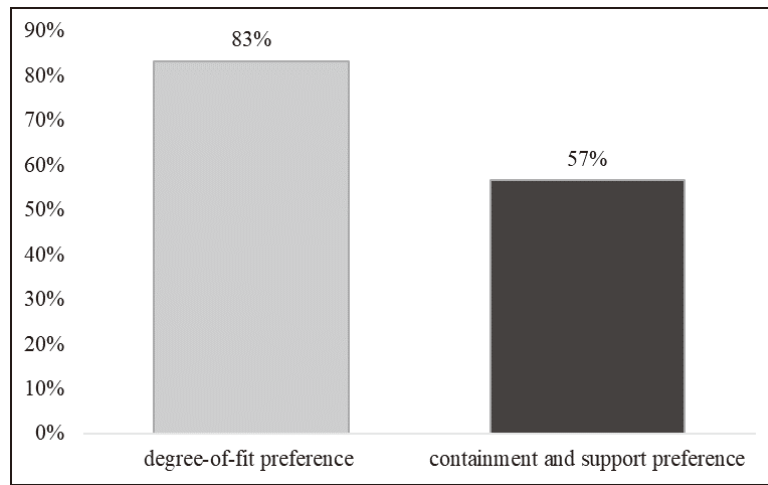

Figure 2. Mean of containment and support preference and degree-of-fit preference response

The mean of the degree-of-fit preference was 12.5 whereas the mean of the containment and support preference was 8.5. A t-test was performed on the data and the difference between the two types was not statistically significant (t = 1.512, p = 0.09). This experiment revealed no significant spatial preference in native Japanese speakers. Table 2 presents the number of participants' choices across exemplars for each Triad Type for each L2 proficiency level group. These scores were analyzed with a chi-square test and the expected value was set to half of the number of participants. As a result, TT3, TT4, TT5 and TT8 showed meaningful conformity on degree-of fit categorization and therefore it is proved that both the high-score group and the lower-score group preferred degree-of-fit relations. In the capacity of causal factors, it is assumed that containing congruous containment and support implications plus degree-of-fit aspects helped participants to select the matched choice.

Table 2

Triad types and number of choice by L2 proficiency level for the language contrast

Triad Type	Target: Choices	high-score group (n=7)	lower-score group (n=8)	X^2	P-Value
Target: tight or loose containment					
TT1[b]	T-IN[a] : l-in vs. l-on	7	2	4.50	0.03
TT2	L-IN: t-in vs. t-on	5	3	0.89	0.34
TT3[c]	L-IN: l-in vs. t-in	6	7	4.04	0.04
TT4[d]	T-IN: t-in vs. l-in	7	6	4.50	0.03
TT5[e]	T-IN: t-on vs. l-on	7	7	5.75	0.02
TT6	L-IN: t-in vs. l-on	5	4	0.64	0.42
TT7	T-IN: l-in vs. t-on	5	7	2.89	0.09
Target: loose support					
TT8[f]	L-ON: l-on vs. l-in	1	1	7.39	0.04
TT9[g]	L-ON: t-on vs. l-in	6	0	5.79	0.02
Target: tight support					
TT10	T-ON: t-in vs. l-in	3	7	2.32	0.13
TT11	T-ON: t-in vs. l-on	2	3	0.89	0.34
TT12	T-ON: t-on vs. t-in	4	6	1.07	0.30

Note. [a]T-IN (t-in): tight containment; L-IN (l-in): loose containment; L-ON (l-on): loose support; T-ON (t-on): tight support.
b~g Cross-linguistic difference is significant, $p < 0.05$.

Furthermore, there are significant results for TT1 and TT9. In particular, one trial of the present experiment, TT9, corresponded with both languages' preference (degree-of-fit or containment and support). The target video showed loose support (loose on) and the following choices were tight support (tight on) and loose containment (loose in). Six participants of the higher-score group chose the support relationship but the entire lower-score group chose the degree-of-fit relations. That is, the higher-score group categorized space using the containment and support relationships at TT 9 while the lower-score group missed this.

5. Discussion

The present research postulates that the grammatical system in our language may affect what we think in reality; this is widely comprehended as the Sapir-Whorf hypothesis (Whorf 1956) or the language relativity hypothesis (Lucy 1992). In this experiment, it was not revealed that Japanese speakers truly categorize space relations based on the degree-of-fit like Korean monolingual speakers do, such as the pattern reported by Choi & Hattrup (2012). However, participants showed a high ratio of degree-of-fit preference compared with containment and support preference, and so it is presumed that there is a tendency for native Japanese speakers to focus on degree-of-fit categorization more when they classify spatial situations.

Therefore, it is natural to hypothesize that this habit of thinking space was determined by the factor that Japanese own the words hameru and ireru corresponding with the words kkita and nehta in Korean. These results suggest two suppositions: one being that Japanese has quite similar cognition properties about space compared with Korean and the other is that a language (L1) can shape how we categorize spatial relations.

In another analysis, these results are evidently an implication of L2 acquisition influence on L2 users' spatial cognition and that the degree of effect is related to proficiency in L2. It was only one trial (TT9), and yet the higher-score group showed that he classification pattern was different from the lower-score group. The important difference did not appear in other trials, but the lower-score group showed a tendency to choose the degree-of-fit relations and the higher-score group could be supposed to be sensitive to the containment and support relations. As a consequence of learning a L2 (English), Japanese speakers gradually shifted their spatial categorization preference patterns from focusing on the degree-of-fit relations to the containment and support relationships. The results can be seen as experimental support research concerning space thought for Cook's multi-competence hypothesis (1991). Albeit if our cognition is shaped by L1 once, it can be restructured by acquiring L2 or more languages.

However, it should be emphasized that while bilinguals' cognitive mechanisms are undoubtedly different to monolinguals' the degree of change is only very slight.

Murahata and Murahata (2016) claimed that the quantity of cross-linguistic effects is statistically revealed when two groups whose L2 proficiency is different are compared in certain variables. Even if the effect is small, the present research exposed that bilinguals recognize the space representations in a different way from monolinguals. According to Grosjean (1989), a bilingual is not composed of two monolinguals in one person but is an original and also appropriate language system user. Cook (2002) characterized an L2 user (bilingual) as a person who has different knowledge of the L1 and the L2, different metalinguistic awareness and different cognitive processes to monolinguals.

Remarkably, in the present research, both groups almost missed the point to be equal with the target video in TT8; however there was a significant result in that the higher-score group was responsive to the perspective of the target video in TT9. Analyzing the quality between TT8 and TT9, the choices of TT9 included an opposite degree-of-fit relation (t-on), although both the target video and the choices of TT8 were all loose connections. In other words, due to the lack of degree-of-fit distinction in TT8, the participants hardly distinguished the containment and support relationship like English monolingual speakers, regardless of their English proficiency level. On the contrary, in the situation which contains both Japanese and English properties, such as TT9, it is inferred that the degree of L2 proficiency could be a significant factor. These results imply that bilinguals' recognition capacity undoubtedly accepted the influence of L1 even when their L2 proficiency level rose and also that they organized a new viewpoint in which the two or more languages mixed.

There are some factors to consider for future research. Firstly, the English proficiency level of the participants in this study was not controlled much due to the administration and measurement of their linguistic background. Participants took the English placement test, with the best score being 38 and the worst score being 17 (max = 60 points). Most participants scored around 30 points. Further research could distinguish linguistic ability more clearly by comparing L2 advanced speakers and almost L1 monolinguals who have both never stayed in an L2-speaking environment.

Secondly, there is a strong possibility that the amount of language exposure plays a crucial role in shaping our thoughts. For example, some participants of the present observation had stayed in Korea for almost one year, and so therefore their proficiency

level in and amount of exposure to Korean might be higher than that of English. They had obviously started studying English (for more than eight years) earlier than Korean as their L2 but had never stayed in English-speaking countries. Boroditsky (2001) contrarily insisted that the starting age of L2 acquisition plays a more forceful role on Chinese-English bilinguals' thoughts about time while the length of L2 exposure scarcely generates effects. In this case, however, it would be assumed that Japanese speakers were strongly influenced by Korean spatial cognition rather than by English.

6. Conclusion

The present study attempted to explore if L2 learning influences bilinguals' cognitive processes, especially how to categorize space. The results implied that as the level of L2 proficiency becomes higher L2 learners not so dramatically but definitely shifted their spatial categorical preferences. Accordingly, these findings certainly provide further evidence that support the multi-competence hypothesis by suggesting that the bilinguals' perceptions are restructured as a consequence of acquiring an L2. Athanasopoulos (2009) concluded that "concepts in the human mind are flexible, changing and susceptible to both linguistic and cultural influence" (p. 93). It has been contentiously researched if a pre-existing concept creates the linguistic device to represent it or whether the linguistic device creates the concept in the speaker's mind, and yet the results of the current study support the view that language influences cognitive dispositions by directing speakers' attention to specific features of objects. Future research will obtain a clearer understanding of the mechanisms by which bilinguals' cognition has been constructed.

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