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Title	Complications in the L2 acquisition of the simple spatial prepositions in and on Crosslinguistic differences in image schema and family resemblance
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Citation	Journal of Second Language Studies , 3 (1) : 141 - 154
Issue Date	2020-04-10
DOI	10.1075/jsls.18015.taf
Self DOI	
URL	https://ir.lib.hiroshima-u.ac.jp/00050931
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Relation	



Complications in the L2 acquisition of the simple spatial prepositions *in* and *on*

Crosslinguistic differences in image schema and family resemblance

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1. Introduction

This paper, a part of a large-scale project on teaching English prepositions to second language (henceforth L2) learners, reports common, but far often neglected, errors using the high-frequency prepositions *in* and *on*. Related to the present topic is Taferner and Yamada's (under review) investigation, which found that the considerable difficulty Japanese learners have concerning the apparently simple spatial prepositions *in* and *on* is attributable largely to the differences in image schema (Johnson, 1987, 2005; Lakoff, 1987; Dodge & Lakoff, 2005; Grady, 2005) involving the figure (located object) and ground (reference object) (Zlatev, 2005) relations between English and Japanese. This contrastive analysis in the context of prepositional usage is novel (see e.g., Odlin, 2005), differing markedly from spatial cognition studies such as Landau and Jackendoff (1993), Garrod, Ferrier, and Campbell (1999), Talmy (2000, 2005), Gentner and Bowerman (2009), and Feist and Gentner (2012), which suggest the importance of this research in many languages. To our knowledge, Taferner and Yamada's (under review) study, which is subsumed under the rubric of cognitive linguistics-oriented teaching research (cf. Boers, 2013), is likely the first to investigate the potentially substantial first language (henceforth L1) interference effects arising from differences in image schematic spatial properties (Correa-Beningfield et al., 2005; Mandler & Pagan-Canovas, 2014) of prepositional complements between two languages.

In brief, Taferner and Yamada (under review) devised “a picture-drawing and picture-description paradigm.” This data elicitation method of linking visual perception to language usage stems from much earlier work on the visual aspect of multimodal spatial representations (Chilton, 2014; Deane, 2005; Grady, 2005; Hart, 2014; Kosslyn, 1980; Langacker, 1991; Machin, 2009). In their study, after

the participants filled in the blank for each test sentence construction, “Can you see the figure ___ the ground?” they drew a picture of the scene that the test sentence indicated. Two weeks later, each participant was presented with only the picture that he/she had drawn and asked to describe the picture in Japanese. One remarkable finding was that only 6% of the intermediate-level college students correctly filled in the blank “birds the tree” with *in* despite the fact the sentence structure and words frequently appear even in middle school English. Inspecting the participants’ pictures and their descriptions of the pictures, Taferner and Yamada (under review) attributed participants’ poor performance largely to differences between the English and Japanese image schema relations for *tree* (spatial ground) and *bird/apple* (spatial figures), suggesting that in many Japanese learners, *tree* elicited a mass-like schema or a skeletal schema with a trunk and branches, i.e., an image schema that grammatically co-occurs with *on*.

The core concepts of *in* and *on* (and their Japanese equivalents, *naka* and *ue*) should be universal, but some image schemas of objects in spatial relations can be language and/or culture specific. For example, Gentner and Bowerman (2009) showed a continuum of support and containment situations as lexicalized in L1 English, Dutch, Spanish, and Japanese: (a) cup on table, (b) band-aid on leg, (c) picture on wall, (d) apple on branch, (e) ribbon on candle, and (f) apple in bowl. In English, *on* is used for support situations from (a) to (e) and *in* for containment situations; in Dutch, *op* is used for (a) and (b), *aan* for (c) and (d), *om* for (e), and *in* for (f); in Spanish, *en* is used for all of the situations; and in Japanese, *ue* is used for (a) and *naka* for (f), and an all-purpose locative marker *ni* for (b) to (e). It would easily be expected on the basis of this continuum of support and containment relations that Spanish and Japanese learners of English would have difficulty learning spatial prepositional relations in (b) to (e), which is viewed as representing non-prototypical situations on the continuum. To our knowledge, however, very little research has been conducted on contrastive analysis of spatial image schemas between English and Japanese or any other two languages. Taferner and Yamada (under review) dealt with the image schema relations between the spatial figure and ground, whereas the current study focuses on only the spatial ground, *car* and *boat*, in similar prepositional contexts.

Landau and Jackendoff (1993, p. 231) state that “... when traveling, one is *in a bus* or *on a bus* but only *in*, not *on*, a car. It seems that in English, large vehicles (e.g., buses, yachts, trains, and large airplanes) are conceptualized either as containers that one is *in* or types of platforms that one is *on*, but small vehicles (e.g., cars, rowboats, and small airplanes) are only conceptualized as containers”. We add for educational purposes that to co-occur with *on*, vehicles should be large enough for passengers to walk around on the floor (or deck); e.g., the boat is assumed to be large in “Can you see passengers on (the deck of) the boat?” This

Complications in the L2 acquisition of the simple spatial prepositions *in* and *on* 143

addition would explain why large vehicles co-occur with *on*. Vehicles in Japanese, on the other hand, are viewed as containers regardless of their size, and vehicles typically co-occur with *naka* (meaning *in*). Such being the case, we predict that Japanese learners would misuse *in/on* with *boat* whose image schema can be ambiguous in terms of size. Specifically, because Japanese learners know that the basic meanings of *in* and *on* involve containment and contiguity, respectively, and that both *car* and *boat* are viewed as containers, they would choose *in* for both *car* and *boat* unless other factors operate otherwise. However, one factor seems to differentiate between *car* and *boat*; that is, differential frequency of and/or exposure to prepositional phrases may affect learning. It is very likely that learners are exposed to phrases such as “on the boat” but not exposed to phrases such as “*on the car.” (Note that we regard “*on the car” as pragmatically ungrammatical when taking ordinary circumstances into consideration. Of course, sentences such as “I saw Michael Jackson (standing) on a car” is grammatical. According to Google Ngram, “in the car” is eight times more frequent than “on the car.”). It is thus predicted that Japanese learners would correctly or incorrectly choose *on* for *boat* more often than for *car*. To be more specific, for *boat*, learners would choose *on* correctly for a large boat and incorrectly for a small boat (e.g., canoe, lifeboat). On the other hand, for *car*, Japanese learners would consistently and correctly choose *in* and correctly avoid *in* unless counter effects are exercised otherwise. One possible counter effect is that of family resemblance. Learners may consider that if “on the boat” is acceptable, “on the car” would also be acceptable even though they have not encountered it before. This is a possible effect of family resemblance, which we will describe in more detail in the Discussion section.

While image schemas for vehicles differ between English and Japanese, there exist many crosslinguistically shared image schemas between them. Perhaps nouns such as *field*, *bowl*, *box*, and *bathtub* and the corresponding Japanese nouns would be such shared image schemas, and cause little or no difficulty for Japanese learners to use them. Thus, they can be used as control items and boat and car as experimental items. Taken together, the accuracy order from low to high would be: *boat* < *car* < *field*, *bowl*, *box*, *bathtub*. The main purpose of this study is to verify this hypothesis.

2. Methods

2.1 Participants

This investigation was conducted with 51 1st-year undergraduate Japanese university students (29 females and 22 males) with an average TOEIC score of 562.2

($SD=75.2$) and ranging in age from 18 to 19 years old. These intermediate-level EFL students were enrolled in two English Speaking classes held in the first semester and majored in a variety of humanity and science programs. Participants of this study signed a consent form that allowed researchers to utilize data elicited from the students, adhering to ethical research standards of the university. The students responded to grammar questions that were designed to elicit and measure two English prepositions, *in* and *on*.

2.2 Materials

A grammar test was created to elicit and measure participants' knowledge of the English prepositions *in* and *on* in a classroom setting within 20 minutes. Both English and Japanese instructions for the grammar test were provided to avoid any confusion with regards to the learners' responses. The eight test items included in the design of the test are presented in Table 1. Note that we felt that no distractors were necessary in the grammar test as control items to obtain the results we required. These eight test items attempted to elicit participants' use of *in* and *on* in the test sentence constructions provided as well as 6.5 cm × 4.5 cm boxes for participants to draw what they thought the sentences represented.

2.3 Procedure

The grammar test required participants to write an answer in the blank provided and also the confidence level of their response. Their certainty of their determination of the correct preposition was decided by picking of one of the following choices: 1 (0%–20%), 2 (21%–40%), 3 (41%–60%), 4 (61%–80%), or 5 (81%–100%). One week after the completion of this test, the test sentences and corresponding pictures that were drawn by the participants were separated. Subsequently, only the pictures drawn by the participants were returned to them and then they were asked to provide a Japanese sentence that represented the picture they drew. This procedure allowed for only visual interpretation of the scene, which limited the influence of L2 and other sensory stimulus when they wrote in Japanese.

3. Results

The coding of the results allowed for correct responses to be evaluated by the authors through a two-step procedure: (1) the prepositions chosen and (2) the pictures drawn and their verbal descriptions. For example, for test item 8 (*Jackie in/on the boat*), Case 17 chose *on*, which could be correct, but the picture she

Complications in the L2 acquisition of the simple spatial prepositions *in* and *on* 145

drew (Figure 1A) did not represent an appropriate scene that the *on*-response indicates, and so her *on*-response was taken as incorrect. For the same test item, Case 18 chose *on* and her picture (Figure 1B) correctly depicted an appropriate scene, so that her response was counted as correct. Reliability of the coding of the images required the determination of whether or not the drawings represented the English or Japanese sentences. Since the drawings were readily interpreted, the two researchers involved in the coding were quickly able to agree with the coding of all of the items.

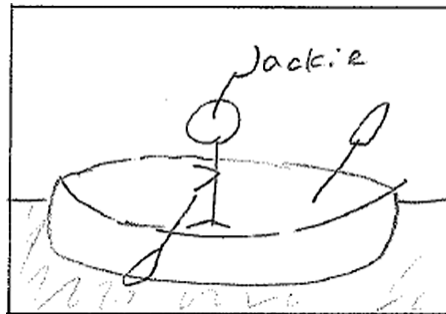
Correct *in/on* responses (%) and confidence levels for the eight test items with irrelevant responses (e.g., “*behind* the car”) excluded from analysis are presented in Table 1. The performance in the *boat* context was the worst of all, 27.5% correct, followed by the *car* context, 79.6% correct. The remaining performances were good, ranging from 91.5% to 100% correct. The percentage of correct responses for item 8 (*in/on* the boat) was significantly smaller than that for item 6 (*in* the car) 14/51 vs. 35/44, $\chi^2(1)=16.33$, $p<.001$, $\phi^2=0.46$). However, the percentage of correct responses for item 6 (*in* the car) was not significantly smaller than that for test item 4 (*on* the log), 35/44 vs. 43/47, $\chi^2(1)<1$. Therefore, this order coincides with the prediction made in the Introduction.

Table 1. *In/On* Responses and Confidence Levels for the Test Items ($N = 51$)

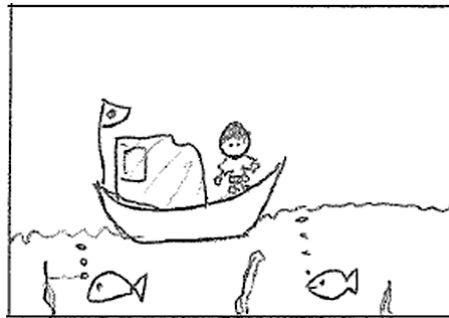
Test sentences	Response	Confidence level
	Mean %	Mean (<i>SD</i>)
1. Can you see the children __ the field?	95.5 (42/44)	3.41 (0.85)
2. Can you see John __ the bathtub?	95.8 (46/48)	3.33 (0.97)
3. Can you see oranges __ the bowl?	95.8 (46/48)	3.54 (0.88)
4. Can you see frogs __ the log?	91.5 (43/47)	3.16 (0.99)
5. Can you see chocolate __ the box?	98.0 (50/51)	3.57 (0.90)
6. Can you see Tom __ the car?	79.5 (35/44)	3.51 (0.92)
7. Can you see the ball __ the glove?	100.0 (46/46)	3.22 (0.99)
8. Can you see Jackie __ the boat?	27.5 (14/51)	3.45 (0.90)

Note. Correct prepositions: 1 (*in/on*), 2 (*in*), 3 (*in*), 4 (*on*), 5 (*in*), 6 (*in*), 7 (*in*), and 8 (*in/on*).

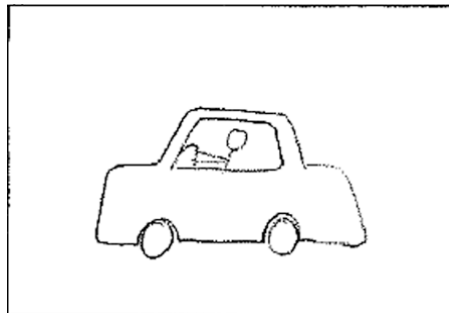
It was noticed that the mean confidence levels were not very high across the test items, ranging from 3.33 to 3.54 (with items 4 and 7 excluded), which means 50% or less confidence levels. In fact, the effect of test item was not significant for the target items 1, 2, 3, 5, 6, and 8, $F(5, 50) = 1.44$, $p > .10$. This is an important finding regarding the reliability of participants' performances, which we will return to in the Discussion section.



A. Case 17 chose *on*, but because it is not consistent with the picture she drew her *on*-response was counted as incorrect. Note that Jackie seems to be sitting on the floor of the boat. Her confidence in this response was 5 points



B. Case 18 chose *on* and it is consistent with the picture she drew. Her confidence in this response was 3 points



C. Case 27 chose *on* although the figure and the ground (the driver and the car) seems to show a container-contained relation. His confidence in this response was 3 points

Figure 1. Examples of Test Item Prepositions and Pictures

Complications in the L2 acquisition of the simple spatial prepositions *in* and *on* 147

A further analysis was conducted for *in/on* responses to items 6 and 8, “Tom __ the car” and “Jackie __ the boat”. The purpose here was to determine how many learners made correct responses for both test items. Theoretically, there are 12 response patterns for items 6 and 8: *in-in*, *in-*in*, **in-in*, **in-*in*, *in-on*, *in-*on*, **in-on*, **in-*on*, **on-in*, **on-*in*, **on-on*, and **on-*on*, where an asterisk indicates ungrammaticality. Of the 12 possible patterns, only four patterns were empirically observed: *in-in*, *in-on*, *in-*on*, and **on-*on*. The percent of these patterns and their mean confidence levels are presented in Table 2. Two points are noted. First, only 18% of the learners (*in-in* and *in-on* combined) were correct for both test items, thereby suggesting that few learners could correctly use the prepositions *in* and *on* with the vehicles, *car* and *boat*. Second, the mean confidence levels were not high for the correct patterns, *in-in* and *in-on*. These low confidence levels suggest that the learners’ usages of these prepositions are unstable and/or unreliable.

Table 2. *In/On* Response Patterns (%) for “Tom __ the car” and “Jackie __ the boat” and Mean Confidence Levels

	Response pattern			
	<i>in-in</i>	<i>in-on</i>	<i>in-*on</i>	<i>*on-*on</i>
Mean %	11.8	5.9	49.0	15.7
Confidence level	3.9	3.8	3.6	2.9

Two questions are raised as to the *in-* and *on-*responses to test items 6 and 8 (“*in/on* the car” and “*in/on* the boat”) because the pattern of responses was asymmetrical; that is, the proportions of *in-*responses were 66.7% for item 6 and 13.7% for item 8, and those of *on-*responses were 17.6% for item 6 and 78.4% for item 8. First, the proportion of *on* for item 8 was as high as 78.4%, but 84% of the *on-*responses turned out to be incorrect when we examined their pictures. Note that the authors easily and confidentially interpreted the pictorial representations of the English sentences drawn by the participants. Moreover, no practice trials were required to produce the visual images needed for the purpose of this study. Second, for item 6, because learners would not have encountered the ungrammatical prepositional phrase **on the car* in their English language learning, we would expect the proportion of *on-*responses to be 0%. Why was the proportion 17.6% instead of 0% here? As mentioned in the Introduction, this may be attributable to the effect of family resemblance, which we will discuss below.

4. Discussion

The most surprising finding in this study was that those who correctly responded to both test items 6 and 8 (“_ the car” and _ the boat”) accounted for only 18% (Table 2). Moreover, those correct responders were not fully confident about their responses. Prior to discussing the questions posed by this investigation, the issue concerning the reliability of the test used in this study should be stated. One may point out as a limitation of this study that the number and variety of test items and tokens were very few. However, we are reminded that “any single test is only an estimate based on a sample of performance” (Cronbach, 1977, p. 267) and an increase in test items would not solve the reliability problems especially if we continue to use ambiguous fill-in-the-blank test items. The reliability of the present test is associated with the participants’ relatively low confidence levels of their responses (Table 1). More importantly, it also represents participants’ knowledge of the prepositional phrases tested. Given this background, the authors are quite confident of the results because of the additional information obtained from the picture-drawing task and the picture-describing task; the reliability and face validity of the findings would be satisfactory. For example, Case 17 (Figure 1A) is very likely to use *on* not only for a small boat but also for a large boat; on the other hand, Case 18 (Figure 1B) may or may not use *on* for a small boat. In this regard, we should conclude that Case 18’s knowledge of “*in/on* the boat” may not necessarily be adequate even though the responses was counted as correct under the present testing conditions. In future research, unambiguous fill-in-the-blank items such as “__ a rowboat” and “__ a big boat” should be provided in place of ambiguous items such as “__ a boat” if a picture-drawing task and a picture-describing task are not given.

Returning now to the main focus of the study: Why are these prepositional phrases so difficult to use? More specifically, how can we answer the two questions raised above? This study was concerned with the ground in the test scene, which we now contend different image schemas for the ground (i.e., prepositional complements, *car* and *boat*) between Japanese and English and in addition, family resemblances of these vehicles are the underlying cause of the difficulty. As for *boat*, native English speakers would view the small boat in Figure 1A as a container (and Jackie as the figure contained), whereas many Japanese speakers may, though unconsciously, pay more attention to the bottom (floor or bilge) of the boat and view Jackie on (the floor of) the boat. It is also noted that a (small) boat shares a family resemblance with a raft and a floating log, which grammatically and cognitively co-occur with *on*. Furthermore, Japanese learners might have heard and/or read prepositional phrases such as *passengers on a (large) boat*, not paying attention to the size of the boat. In fact, according to Google Ngram,

Complications in the L2 acquisition of the simple spatial prepositions *in* and *on* 149

currently the frequency of “*on* a boat” is about the same as that of “*in* a boat,” which would be reflected in the teaching and learning of English as an L2.

As for *car*, while Japanese learners, correctly perhaps from a universal perspective, have a container image (see Figure 1C); some may associate its image schema with that of various vehicles including *bus* that co-occurs with *on* (and less frequently *in*). This association is activated because both *car* and *bus* are prototypical of the category vehicle, and share a high degree of family resemblance with each other (e.g., Rosch & Mervis, 1975); consequently, some learners would tend to take the usage of these vehicles in the prepositions to be the same. Thus, what learners have to learn is the crosslinguistic fact that *bus* co-occurs with *in* or *on*, depending on its image schema in a given context, whereas *car* co-occurs only with *in* because it almost always has only the container image schema in ordinary contexts.

This interpretation in terms of image schema is at least in part supported by the participants’ descriptions of their pictures. The Japanese spatial nouns *naka* and *ue* are equivalent to *in* and *on*, respectively, and the Japanese spatial verb *noru* typically means “to get on,” “to go on,” or “to be on”. For example, “a bird on her hand” may be translated into Japanese by selecting *ue*, *noru*, or both. The proportions of these terms chosen in the descriptions of the pictures (with those who made no responses or irrelevant responses in this verbal description task were excluded) are summarized in Table 3. The pattern of the proportions of *naka* and *ue* for *car* and *boat* in Table 3 is similar to that of *in* and *on* reported in the Results section in that *in/on* responses clearly exhibit a similar interaction between term (*in/on*) and vehicle (*car/boat*), i.e., *in*: 66.7% and 13.7%, and *on*: 17.6% and 78.4% for *car* and *boat*, respectively. For *car*, the proportion 20.5% for *noru* reflects an *on*-image schema and the proportion 50.0% for *naka* an *in*-image schema. For *boat*, the proportions 43.9% and 58.5% for *ue* and *noru* respectively represent an *on*-image schema. These differential patterns are by and large consistent with the answer to the questions raised above.

Table 3. Japanese Spatial Terms (*naka*, *ue*, and *noru*) and Picture Descriptions for Test Items 6 and 8 (*car* and *boat*)

Test item	Japanese spatial terms		
	<i>naka</i> (M %)	<i>ue</i> (M %)	<i>noru</i> (M %)
6 (<i>car</i>)	50.0 (20/40)	0.0	20.5 (9/44)
8 (<i>boat</i>)	19.5 (8/41)	43.9 (18/41)	58.5 (24/41)

A pedagogical implication of the present findings is evident. What is needed in a classroom setting is explicit instruction of crosslinguistic differences in image

schema for figures and grounds of prepositional phrases. Without such instruction, L2 learners would probably continue repeating a trial and error approach to their prepositional usage indefinitely, and, as is the case of the participants in this study, do not have high confidence in their usages of even the high-frequency prepositions *in* and *on*.

One grammatical item we need to include in teaching *in* and *on* regarding vehicles should be the effect of the size of vehicles (Landau & Jackendoff, 1993). This is because in many cultures, the size of vehicles would, though unattested, be irrelevant in describing spatial relations. As stated in the Introduction, however, *on* generally collocates with large vehicles and *in* with small ones. Such being the case, we should add for pedagogical purposes that a passenger(s) can walk around *on a large vehicle* whereas a passenger(s) are contained in a small vehicle or that large vehicles and passengers are consistent with support-from-below relationships. This is an appropriate image schema we should show to Japanese learners and possibly other L2 learners from other linguistic backgrounds. It should be emphasized, however, that a simple rule such as *on*=large and *in*=small does not always work. For example, Quirk and Greenbaum (1973, p. 147) point out that the effect of size is the opposite in the following case: “on the island: Robinson Crusoe was marooned on an inhabited island (the island is small)” versus “in the island: He was born in (the island of) Cuba (the island is large or a political entity with boundaries).” Perhaps we don’t have a simple general rule and should present learners with an explicit image schema for a limited set of prepositional complements.

This discussion poses a new, exciting challenge for applied linguists (and also for psycholinguists and cognitive linguists alike). The number of nouns that L1 children and L2 learners learn may be small, but there are a potentially infinite number of images, which are created from nouns. Those images are abstracted and categorized into relevant image schemas for language use. Two concrete examples concerning the case of Japanese learners may be worth mentioning here. First, image schemas of seemingly simple object categories may be difficult for L2 learners to figure out. In the Introduction, we mentioned a continuum of support and containment situations ranging from the prototypical *on* relation (a) *cup on table* to the prototypical *in* relation (f) *apple in bowl* (Gentner & Bowerman, 2008). On this continuum, the difference between the image schemas of (a) and (f) seems to be so clear that no difficulty may appear to arise in learning these spatial relational expressions. However, such is not always the case. For example, the category chair includes many different chairs. The chair in “in the chair” is different from the chair in “on the chair,” but it is not always an easy task to classify chairs into the *in*-group or the *on*-group (e.g., Pinker, 1999, pp. 272–273). Nevertheless, L1 children, whether innate or learned, somehow acquire the

Complications in the L2 acquisition of the simple spatial prepositions *in* and *on* 151

differences between them (cf. McDonough, Choi, & Mandler, 2003). Such is not the case for L2 learners, however. Japanese speakers, for example, have no image schema for chairs in which they can sit in. The spatial prepositions *in/ on* do not perfectly correspond to their Japanese counterparts *naka/ue*, e.g., *on the chair=isu-no (chair) ue*, but *in the chair* = □ **isu-no naka*. The difficulty that Japanese learners face lies exactly there. In the Japanese learners' mental lexicons, there exist no chairs in which they can sit. With no explicit explanation of the image schema for the *in*-type of chairs provided, Japanese learners would be mystified and fail to acquire the pragmatic meanings of those prepositional phrases. The challenge is to identify and contrast such prepositional phrases and to devise explicit image schematic explanations for educational purposes (e.g., Boers, 2013; Boers & Demecheleer, 1998; Evans & Tyler, 2005; Lindstromberg, 1996; Shintani, Mori, & Ohmori, 2016).

Second, the basic properties of figure and ground may not be universal or self-evident. Specifically, an object that is regarded as ground in one culture may not be taken as such in another culture (Correa-Beningfield et al., 2005). For example, *the cat in the hat* is ambiguous: (a) the cat that wears the hat and (b) the cat that is put in the hat, where the cat is regarded as the figure and the hat as the ground. But the Japanese translation, *hat-no naka-no cat*, is not ambiguous but means (b) only. That is, if *the cat in the hat* means (a) the cat wears the hat, the hat is not seen as the ground of the scene but rather as a part of the part-whole relationship. Thus, when Japanese learners hear or read the phrase *the cat in the hat*, they would interpret it as meaning (b) the cat that is put in the hat. More generally, because in Japanese, clothing items such as shirts, shoes, and gloves do not associate the image schema, container, with them, the prepositional phrases representing the container image are difficult to learn or use.

5. Conclusions

It is often observed that English prepositions are one of the most difficult grammatical categories for L2 learners (e.g., Tyler & Evans, 2003). The difficulty lies not only in the abstract polysemy of prepositions but also in the figure-ground relations in various scenes that differ crosslinguistically. This implies that in teaching prepositions, it is not enough to teach the lexical meanings of prepositions and co-occurring nouns. In addition, teaching the relevant aspects of the figure-ground relationships in the scenes represented in prepositional phrases is required. This is a formidable challenge, even if we limit ourselves to high-frequency nouns in the preposition context, as the results of such efforts would make a great contribution to teaching English as an L2.

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