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Relation	

Crosslinguistic Image Schema Differential Hypothesis Clarifies Non-Prototypical and Polysemous Spatial Preposition ‘on’ for L2 Learners

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Abstract

In this article, we propose to account for expressions of non-prototypical spatial relationships between languages by introducing the Crosslinguistic Image Schema Differential (CISD) Hypothesis to examine various uses of the English preposition on produced by L2 (second language) learners. The most remarkable findings were that two space-relational types (encirclement with contact and at an edge) and one image schema (concave surface) were almost completely lacking in the students who participated in this study. This investigation indicates that simple explicit explanations

of such non-prototypical polysemous senses are possible utilizing the CISD Hypothesis.

Keywords: spatial prepositions, semantic topology, image schema, explicit instruction, crosslinguistic analysis

1. Introduction

Prepositions have attracted the attention of many researchers, as they are some of the most difficult grammatical features of many languages to learn and acquire. The acquisition of prepositions or more broadly adpositions (i.e., representing pre-, mid-, or post-position particles) have long been under investigation by both first language (L1) and second language (L2) researchers (e.g., Landau, Johannes, Skordos, & Papafragou, 2017). These investigations have primarily been based on cognitive linguistic interpretations of space through prototypical scenes, and extended through polysemous and abstract senses, which can vary in their linguistic meanings and forms throughout the languages of the world. At present, however, the effect of such cognitive semantic

research on the applied theory of second language learning is limited. The main purpose of this study is to attempt to account for the difficulty L2 learners have in learning the English preposition *on* through a new contrastive analysis termed Crosslinguistic Image Schema Differential (CISD) hypothesis as compared with a much broader analysis of Gentner and Bowerman's (2009) Typological Prevalence (TP) hypothesis.

1.1. Degree of prototypicality of image schematic spaces and learnability

Prototypical prepositional features in English represent central or common lexical properties of a particular preposition (e.g., *on*) as seen in (1), extended to (2), and further abstracted by (3).

(1) The ball is *on* the table.

(2) The story is *on* page one.

(3) The deal is *on* the table.

Accordingly, Sentence (1) is prototypical, Sentence (2) is less prototypical, and Sentence (3) is least prototypical or non-prototypical. From the perspective of language learning, (1) is easy for both learners of English not only as L1 and but also L2, (2) is

less easy, and (3) is the most difficult (c.f. Langacker 1987; Rice 1992, 1996; Tyler and Evans 2003). For L1 learners, (1) is easy to learn since both the ball and the table are physical objects and the ball is readily recognized as a prototypical figure (henceforth Trajector-TR) in physical space and the table as the prototypical ground (henceforth Landmark-LM). (2) is polysemous and therefore more difficult than (1) because the story is a mental entity that indicates a description of events and people. It is the written text that is physically on the page not the story; therefore the learner has to metaphorically create a mental space where the story (target) is associated with the text (source) as the TR and the page as the LM. (3) is abstract and thus more difficult than (2) as both the deal and the table in (3) are mental entities to be created metaphorically and some image schema transformation is required to interpret (3). This relationship between prototypicality and language learning difficulty seems consistent with Gentner and Bowerman's (2009) TP hypothesis, which we will discuss later in detail.

At first glance, essentially the same difficulty order may be expected for L2 learners such as Japanese learners of English (henceforth JLEs). The underlying mechanisms that account for the order, however, are different between L1 and L2

learners of English; (1) is easy for JLEs to learn for essentially the same reason as in L1 learners' case. That is, (1) projected from the image schematic concept, SURFACE CONTACT, is cognitively simple and easy to comprehend even though (1) does not necessarily depict the same image schema (see below). (2) is more difficult than (1) as the story, which is also a mental entity, may be easily viewed by the JLEs as representing a TR analogous to a physical object like a *ball*, the *page* is likely to be taken as a CONTAINER LM rather than SURFACE CONTACT LM. Thus, (2) *on the page* may sound somewhat strange to many JLEs as the translation *pe-ji no ue no (on)* is ungrammatical but *pe-ji no naka no (in)* is grammatical. (3) is more difficult than (2) partly for the reason that the *deal* (TR) is a mental entity, or more specifically because it is metonymically used. We can imagine that the documents (TR) for the deal are on the table (LM). However, JLEs would not be able to form a spatial event in (3). The reason lies in the function of the *table* in Japanese culture; that is, in Japanese culture, the table does not metaphorically function as a place for a deal or discussion. These three cases illustrate a scale of difficulty ranging from prototypical to abstract scenes with varying degrees of difficultly dependent on an L1 or L2 perspective. It can be

argued that when the complexity of the scene increases learnability in both L1 and L2 is affected accordingly. With regards to the difference in cognitive complexity, cultural influences can have a strong and direct effect on comprehensibility and interpretation, and therefore requiring further investigation into prototypical, translatability, and metaphorizability of spatial events.

1.2. Prototypicality, translatability, and metaphorizability

The three examples above suggest that for L2 learners such as JLEs, the prototypicality of image schematic spaces are interpreted somewhat differently from L1 learners, and thus can be associated closely with the learnability of spatial prepositions. As suggested above, the degree of difficulty may differ between the two learner groups. For L1 learners, the difficulty order may be represented as (1) < (2) < (3), where the inequality symbol < is read as "is easier to learn than." For JLEs, the order may be (1) < (2) << (3), where the symbol << is read as "is much easier to learn than."

The examples above indicate that while it is important both for native speakers and for JLEs to know the target spatial relations, expressed in (1) to (3), those underlying spatial relations exhibit different properties of TR and LM for these

learners. The above discussion is summarized in Table 1.

Table 1. Prototypicality of TR, LM, and Image Schemas (IS) in (1) to (6).

English	TR	LM	Image schema	IS Prototypicality	Preposition
(1) ball/table	Prototypical	Prototypical	CONTACT	Prototypical	on
(2) story/page	Less prototypical	Prototypical	CONTACT	Less Prototypical	on
(3) deal/table	Non-prototypical	Prototypical	CONTACT	Non-prototypical	on

Japanese	TR	LM	Image schema	IS Prototypicality	Postposition
(4*) boru/teburu*	Prototypical	Prototypical	PART-WHOLE	Prototypical	ni
(5*) monogatari/pe-ji*	Less prototypical	Prototypical	PART-WHOLE	Less Prototypical	ni
(6) *torihiki/teburu*	NA*	NA*	NA**	NA**	ni

Difference in Image Schema between English and Japanese

English / Japanese	Difference
(1) ball/table / (4) *boru/teburu*	Small
(2) story/page / (5) *monogatari/pe-ji*	Medium
(3) deal/table / (6) *torihiki/teburu*	Large

*NA: Not applicable. The torihiki/teburu cannot be metaphorizable as entities in a mental space.

**NA: Not applicable. The torihiki/teburu do not create a spatial image schema.

The differences in some properties of TR and LM between native L1 learners of English and JLEs suggest that it is necessary for them to experience explicit instruction including descriptions of image schemas and their associated prepositions. How can we lead JLEs to discover and acquire them? One way to approach this problem may be

to find the translatability of the target expressions. The Japanese translations equivalent to (1) to (3) are (4) to (6), respectively.

(4) *Boru* (ball) *wa teburu* (table) *no ue* (on/above) *ni aru* (be). [The ball is on the table.]

(5) *Monogatari* (story) *wa sono* (that) *pe-ji* (page) *ni aru* (be). [The story is on that page.]

(5a) **Monogatari* (story) *wa sono pe-ji* (page) *no ue* (on/above) *ni aru* (be). [The story is on that page.]

(6) *Torihiki* (deal) *wa kennto-chu* (under consideration) *desu* (be). [The deal on the table is under consideration.]

(6a) ***Torihiki* (deal) *wa teburu* (table) *no ue* (on/above) *ni aru* (be). [The deal is on the table.]

The double asterisk for (6a) indicates that the sentence is grammatically more irregular than the single asterisk for (5a). This grammaticality order corresponds well to the translatability of (1) to (3), which in turn is associated with the learnability of those sentences; that is, for JLEs, (1) is easy to translate, (2) is a little difficult, and (3) is

most difficult, and accordingly, (1) is easy to learn, (2) is a little difficult, and (3) is the most difficult.

In Table 1, the structural difference between (1) and (4) is evident, however, it may not affect translatability for L2 learners but may reflect some differences in image schema between English and Japanese. Gentner and Bowerman mention the Japanese *ue* and *naka* when they discuss a "continuum of support and containment situations as lexicalized crosslinguistically (Bowerman & Pederson, 1992), with support from below on the left to containment or incorporation into another object on the right" (p. 469). However, they mistakenly place the Japanese *ue* at the left end and *naka* at the right end, regarding them as being as prototypical as *on* and *in*, respectively. The point is that neither *ue* nor *naka* is a postposition but a noun. Thus, *no ue ni* in (4) is a postpositional phrase, which is roughly translated as *at (ni) the top (ue) of (no)*. Such being the case, (4) can be ambiguous; one interpretation is (1) *the ball is on the table*, and the other *the ball is above the table* although the latter situation is rare. This implies that *no ue ni* does not entail SURFACE CONTACT and Gentner and Bowerman's (2009) assumption that *no ue ni* is prototypical is not very accurate. It

thus seems that (4) is less prototypical in Japanese than is (1) in English, whereas (4) is more prototypical than (5).

Consider now (3) and (6). The reason why (3) is the most difficult for JLEs is that this sentence is the lowest on the translatability scale and this lowest translatability is attributable mainly to the lowest metaphorizability of the *table*, the object of *on*. The historical and cultural background of the Japanese *teburu* (*table*), a loan word from English, is as follows. Currently, *teburu* is a basic, high frequency word but is only 200 or so years old in the Japanese lexicon. About 200 years ago, Western-style tables were introduced into Japanese culture and Japanese-style tables (or *chabudai*, *entaku*) were soon replaced by Western-style furniture. At the same time, the loan word *teburu* entered the Japanese vocabulary and was well established as an everyday vocabulary item. Even today, however, the word *teburu* generally means only a dining table but not a negotiating table. Or it may be the case that to the Japanese eye, negotiating, conference, or bargaining tables are indiscernible within a business transaction framework. For example, phrases such as “to sit down at the negotiating table” and “come to the conference table” are translated into “*kosho* (negotiation) *no seki* (a seat)

ni tsuku (to get)"; and "the negotiation table" is generally translated into "*kosho* (negotiation) *no ba* (a place)." Thus, while a Western-style table is ambiguous in that it has a function for eating as in (1) and another function for negotiating as in (3), a Japanese *teburu* has a function only for eating. Accordingly, *deal* and *table* create a spatial TR-LM event but *torihiki* and *teburu* do not. This is the main reason why (3) sounds strange to JLEs and is likely difficult for them to interpret.

Gentner and Bowerman (2009) developed the concept of prototypicality related to language learning from a crosslinguistic perspective. To evaluate the prototypicality of spatial image schemas, where TR and LM features are merged to form unified mental representations, and linguistic meanings and forms, is not an easy task. The mental representations are seen as experientially embodied in the interlocutor's mind and body as representative of many languages and their cultures. In exploring the pre-conceptual aspects of mental representations from embodied perception of stimuli to concept formulation, one cannot ignore the differences between languages in how spatial primitives (PATH, CONTAINER, THING, CONTACT, etc.) are initially noticed and perceived and then joined together as

geometrical configurations (TR-LM) creating simple spatial events, i.e., image schemas (PATH TO THING, THING INTO CONTAINER, etc.) (Mandler & Cánovas, 2014: 17).

As we understand it, languages may differ greatly in how they structure spatial relationships between two physical entities (e.g., Levinson & Meira, 2003; Clark, 2004). Such differences are often a chief cause of difficulty in L2 learning (e.g., Evans & Tyler, 2005) even though children appear to learn to encode prototypical spatial systems in their native language relatively easily (Brown, 1973; Landau et al, 2017). Little or no remarkable teaching-oriented discovery, however, has yet been made to narrow or fill the great gap between L1 and L2 learners' ability to cognitively understand and use spatial prepositions although some attempts have been made (e.g., Lindstromberg, 2010; Shintani, Mori, and Ohmori, 2016; Tanaka, 2018). One reason for the failure seems to lie in the inability to specify the different ways to encode prototypical and non-prototypical spatial scenes in different languages, e.g., through image schema as discussed by Mandler and Cánovas (2014: 4-5).

We assume image schemas can provide a common prelinguistic imagery

framework for preverbal as well as verbal meaning construction where individual languages have a minor influence on foundational conceptual notions. These minor crosslinguistic variations in conceptual notions create the space for contrastive analysis to help determine L2 developmental orders. These differences often seem so subtle or hidden (e.g., Jamrozik & Gentner, 2015), especially in many non-prototypical cases that have defied the challenge of researchers. Thus, the central question involves how to determine and account for non-prototypical spatial relationships in any two different languages (e.g., English and Japanese). In this regard, it is essential to attempt an in-depth analysis of the translatability and metaphorizability of target spatial expressions crosslinguistically.

1.3. Typological Prevalence (TP) hypothesis and Crosslinguistic Image Schema Differential (CISD) hypothesis

Gentner and Bowerman's (2009) TP hypothesis proposes that "[all] else being equal, within a given domain, the more frequently a given way of categorizing is found in the languages of the world, the more natural it is for human cognizers, hence the easier it will be for children to learn" (p. 467). While this hypothesis is intended for L1 children,

it is naturally extended to include L2 learners as it is formulated on the basis of crosslinguistic empirical findings. Gentner and Bowerman (2009: 469) showed some samples of support and containment situations lexicalized crosslinguistically and their image schematic relations, which are ordered from prototypical to non-prototypical and equivalently, from easy to difficult, i.e., (i) < (ii) < (iii) < (iv) < (v) < (vi). Table 2 presents them together with the Japanese equivalents.

Table 2. Crosslinguistic comparison of situation types for the preposition *on* and their equivalent Japanese expressions

English	Situation type	Japanese
(i) cup on table	support from below	table *no* cup
(ii) bandaid on leg	clingy attachment	leg *no* bandaid
(iii) picture on wall	hanging against	wall *no* picture
(iv) handle on pan	joined to a surface	pan *no* handle
(v) apple on branch	point-to-point attachment	branch *no* apple
(vi) ribbon on candle	encirclement with contact	candle *no* ribbon
(vii) apple in bowl	containment	bowl *no* apple
(viii) person in armchair	containment	armchair *no* person

*Adapted from Gentner and Bowerman (2009) with (viii) added.

**The Japanese translations with the NP-*no*-NP structure may appear ambiguous presented in isolation, but they are not, if used in appropriate contexts.

It is noted that we cannot readily observe image schematic cognitive features from the

linguistic expressions except that all of the items (i) to (viii) share the primitive image schema CONTACT, e.g., (iv) *ribbon contact with candle*, where *contact with* is translated as *on*, and that in Japanese they share the spatial image schema PART-WHOLE in a broader or metaphorical sense viewing an LM as the body and a TR as its part, e.g., (iv) *ribbon as an added part of candle*, where *as an added part of* is translated as the post-preposition *no*. It is possible to translate (i) to (viii) using locative verbs, thus, (i) table *ni oitearu (to place)* cup, (ii) leg *ni hattearu (to apply)* bandaid, (iii) wall *ni kakatteiru (to hang)* picture, (iv) pan *ni tsuiteiru (to attach)* handle, (v) branch *ni burasagatta* (*to hang*) apple, (vi) candle *ni maiteiru (to attach)* ribbon, (vii) bowl *ni iretearu (to place)* apple, (viii) armchair *ni suwatteiru (to sit)* person. These are paraphrases of the postposition *no* and roughly equal to the labels of the situation types in Table 2.

The order (i) to (vii) presented in Table 2 is determined on the basis of typological prevalence in some 50 languages of the world, however, as Gentner and Bowerman (2009) admit, typological frequency is "an imperfect index to cognitive naturalness" (p. 468). We thus need to formulate a more directly cognitively oriented

hypothesis. The CISD hypothesis, which we propose, may be one such hypothesis. This is a hypothesis with which to make predictions about language learning based upon contrastive analysis of image schemas in two languages and cultures, where image schemas are identified mainly by means of translatability and metaphorizability. "An image schema," according to Oakley (2007), "is a condensed redescription of perceptual experience for the purpose of mapping spatial structure onto conceptual structure" (p. 215). We will now examine each item on Gentner and Bowerman's scale (2009: 469) and evaluate its learnability, noting that the Japanese translations in Table 2 suggest that the underlying images schema across (i) to (vi) is a PART-WHOLE relation.

Type (i) *cup on table* in English, showing a CONTACT and SUPPORT-FROM-BELOW relationship, is prototypical and easy for L1 children to learn. For JLEs, it is also easy but for different reasons. Phrases of this type are generally very common in both languages. More simply, the scenes with a small object on a large object expressed in (i) are cognitively easy to comprehend. Such scenes may be taken as representing a PART-WHOLE relation in a broad or metaphorical sense;

that is, the sentence “The table has the cup on it” indicates a PART-WHOLE relation, the table is the whole object and the cup is part of it. This sentence may sound a little less natural than Lakoff’s (1987) “The table has a vase on it” (p. 558) if the table-related scene is viewed differently. However, this difference in image schema between English and Japanese would not cause any particular difficulty for JLEs as the two image schemas are compatible with each other and learners can view (i) as representing and SUPPORT-FROM-BELOW relationship, the *cup* as the TR being on the *table* as the LM. The translation of (i) into Japanese is very easy as no metaphor is involved here.

Types (ii) *bandaid on leg* and (iii) *picture on wall* respectively show Clingy-Attachment and Hanging-Against relationships in English, which entails a CONTACT relation. In Japanese, situations such as (ii) and (iii) are likely to be grasped in terms of the PART-WHOLE image schema. However, it would not be difficult for JLEs to superimpose a CONTACT image schema on their PART-WHOLE image schema. Japanese learners would then find small differences between Clingy-Attachment and Hanging-Against scenes, and view both (ii) and (iii) as objects

(*bandaid* and *picture*) in contact with vertical surfaces (*leg* and *wall*). Because vertical SURFACE (vertical LM) is less prototypical than horizontal SURFACE (horizontal LM), (ii) and (iii) are a little more difficult than (i) but the difference would be negligible. The degree of learnability would not be different between the two types. We add here that (ii) and (iii) are less translatable; for example, the word-for-word translations of (ii) *leg no ue no bandaid*, and (iii) *wall no ue no picture* are unnatural but not ungrammatical.

Type (iv) *handle on pan* has the *handle* TR connected or joined to the *pan* LM at its surface edge, as a form of SURFACE SUPPORT. This item would be regarded as a polysemous non-prototypical usage in English. In marked contrast, JLEs would take *handle on pan* as a canonical example of the PART-WHOLE image schema, where the metal container is metaphorically the main body and the handle is metaphorically its part. Even with the handle coming off, the metal container alone may be called a pan but without the metal container, the handle is not called a pan. English speakers, of course, may view a pan as consisting of a main body or a metal container and its handle, but when they use the expression *handle on pan*, salient attention is focused on

the CONTACT schema, i.e., the handle (TR) contacting at the surface edge of the metal container (LM). There is thus an image schematic disaccord between English and Japanese. Furthermore, (iv) is the most difficult to literally translate into Japanese. Accordingly, JLEs with this general relational notion would rarely ever correctly choose *on* to encode this spatial relation. This difference in L1 and L2 may cause great difficulty for learners to understand how the L2 spatial primitive is conceptualized, thus relegating the L2 learner to most likely depend on rote memory. We can place additional *on* phrases within this particular sense and many more on this scale. For example, *the house is on the river* (contact at the edge of a surface rather than standing amidst the river) may be placed within Type (iv) because the configuration of the house and the river indicates that the house conceptually touches the edge of a river.

Type (v) *apple on branch* non-prototypically shows a SUPPORT-SUPPORTED relation for branch (LM) and apple (TR) in English, but it weakly realizes a PART-WHOLE relation with branch as the main body and apple as its part in Japanese. With JLEs, these two image schemas may compete with each other, thus causing some difficulty for Japanese learners. Also, (v) is less translatable than (ii) and (iii) can be

slightly more translatable than (iv).

Finally, Type (vi) *ribbon on candle* shows an ENCIRCLEMENT – with – CONTACT relation in English whereas, in Japanese, a PART-WHOLE relation is more appropriate, the part ribbon being viewed as ornamentation or decoration, which is analogous to a clothing-person relation. However, this PART-WHOLE relation is not as strong as (iv) and may be similar to that of (v).

The introduction of the CISD hypothesis attempts to illustrate that the greater the difference in image schematic spatial relations (i.e., TR and LM) between two languages, the more difficult the spatial terms will be to encode in the L2 (e.g., Dodge & Lakoff, 2005; Grady, 2005; Johnson, 2005). This approach to contrastive analysis for prepositional usage is innovative (cf. Odlin, 2005) and considerably different from the spatial cognition research conducted by researchers such as Garrod, Ferrier and Campbell (1999), Talmy (2000, 2005), and Feist and Gentner (2012). Thus, further investigation into the effects of different image schema on L2 learnability for the development of more effective pedagogical practices is required. The TP hypothesis and the CISD hypothesis would then predict the difficulty orders *on* types as follows:

The TP hypothesis: (i) < (ii) < (iii) < (iv) < (v) < (vi)

The CISD hypothesis: (i) < (ii) = (iii) < (v) = (vi) < (iv)

Both hypotheses make a similar prediction about the first relatively easy three types but not the last three, which are more difficult. As for the intermediate-level participants in this study (see the Method section), the correct usage of (i), (ii), and (iii) may reach ceiling levels. We thus need to modify the predictions considering the test items used. We examine this issue in the Method section. In the present study, we first examine the orders of difficulty and then propose explicit image schematic instruction for hard-to-learn types of *on* senses.

2. Method

2.1. *Participants*

The participants of this study included 51 2nd-year Japanese university students who have been studying English from 1st-year junior high school. They majored in a number of subjects including education, economics, and literature at the same university. There were 21 females and 30 males who were 19 or 20 years old. These

students, representative of average university level JLEs, were enrolled in two 2nd-year English composition classes held in the same semester and had an average lower-intermediate TOEIC score of 439.5 (*SD* = 14.9).

2.2. *Test materials, predictions, and procedure*

The data collection materials consisted of a grammar test with 15 test items to elicit and measure participants' knowledge of the English prepositions *on* to further elaborate on the spatial LM support and containment research conducted by Gentner and Bowerman (2009: 469). The eight key test items we analyzed in this study were the following:

1. You can eat the apples ___ (on) the table.
2. He left the book ___ (on) the chair.
3. There is a bandaid ___ (on) her leg.
4. The picture ___ (on) the wall is nice.
5. Spiders can walk ___ (on) the ceiling.
6. We found a small house ___ (on) the river.
7. Look at the wedding ring ___ (on) her finger.
8. Please sit down ___ (in) the armchair.

The remaining seven items were used as distractors which were not analyzed in this study: *The flowers <u>in</u> the vase are so beautiful*; *I happened to meet Taro <u>at</u> the station*; *The smiling gentleman is <u>in</u> a white jacket*; *John is working hard <u>with</u> his friend*; *The*

boy in the hat is walking over there; *This is a picture of my mother*; and *The boy has many toys in his bag*. The main test questions required an answer (i.e., *at, in, of, on,* or *with*) in the blank provided.

To make the test easier, we excluded metaphorical sentences such as *The deal is on the table* (see Introduction) and *The marriage is on the rocks* (Lakoff, 2006: 189). In addition, sub-type (v) *apple on branch* was not included in this current test so as to allow for the investigation of Item 6. Item 6 elicited participants' knowledge *contact on the edge* (*contact without emphasizing support*) in contrast to Item 5, point to point attachment (emphasizing support).

Participants were asked to complete each cloze sentence, translate the sentence into Japanese, and draw a visual image of the test item sentence presented. Given the test items, the predictions made by the hypotheses based upon the example items in Table 2. These predictions should be modified when the level of the knowledge of the participants is taken into consideration. That is, the prototypical items 1 to 5 may reach ceiling levels with no significant differences observed among these items, and the difference between items 6 and 7 should be relatively larger as

there is a gap between them on Gentner and Bowerman's scale. Thus, the modified prediction is 1, 2, 3, 4, 5 < 6 << 7. On the other hand, in the CISD hypothesis, item 3 is placed after item 4 or item 5, because item 3's ground LM (leg) is vertical (90 degrees rotated) and cylindrical, and thus may be more complicated (see Burigo and Sacchi, 2013; Zwarts and Gärdenfors, 2016) than item 4's vertical and flat ground LM (wall). Item 5 is rotated 180 degrees and thus should be more difficult than item 4 but may be comparable to item 3. Items 3 to 5 may not be considerably different in terms of translatability and metaphorizabilty. Item 7 is considered more difficult than Items 1 to 5 because its image schema involves ornamentation that is associated with clothing or covering. Whereas in Japanese, the scene represents a general PART-WHOLE image schema which does not presuppose CONTACT. The word-for-word translation of Item 7 into Japanese is as unnatural as that of Items 3 to 5 while no metaphor is involved in the TR and LM. The most difficult items should be items 6 and 8 because JLEs are indifferent to the target image schematic relations. It is almost impossible for them to evoke a CONTACT image schema from the scene depicted by Item 6. The literal translation of this item ends up with a terrible and incomprehensible outcome. Item 8 is

one of the most difficult items solely in terms of the crosslinguistic differential effect of image schemas; that is, the armchair for JLEs does not have a CONTAINER image schema. The armchair instead has a CONTACT representation, i.e., a prototypical chair. This leads to the prediction that those who select the preposition *on* for Item 2 would also pick out *on* for Item 8. It is noted, however, that the image schema transformation from CONTACT to CONTAINER is so easy that once learners learn the CONTAINER schema for an armchair, they would easily associate the armchair as a ground LM with *on*.

Thus, the predicted order is 1, 2, 4, 3, 5 < 7 < 6, 8. In sum, the chief differences between the two hypotheses lie the non-prototypical items 6, 7, and 8. This grammar test was designed to elicit participants' knowledge within 25 minutes so as to limit the disturbance to regular classroom activities.

2.3. *Data Analysis*

This test consisted 15 test items in three parts: preposition choice, translation, and the picture drawn. We speculated that the first step for the participant to take is to determine what scene the incomplete test sentence depicts. This step would best be

reflected in the drawing task. In this respect, pictures are the most fundamental visual representation, and unless the target scene is correctly depicted, the other two responses can be meaningless or misleading. Thus, for prepositions, we gave a correct response on each test item only if the picture is correctly depicted; otherwise a score of 0 points was given. Similarly, we gave a score of 1 point to the expected translation and the expected picture response for each test item. Thus, we calculated mean preposition, translation, picture, and total scores. We also counted the number of different prepositions the participants chose per test item (i.e., ET) and the Japanese locative terms (i.e., JT) they used in their translations. The hypothesis here is that the more complicated the test item is, the higher the number of different locative terms (where Complexity = ET + JT) learners tend to use.

3. Results

Table 3 shows the main results of the participants' answers to the fill-in-the-blank test items, pictures drawn, and English and Japanese locative terms used. The test items 1 to 7 are ordered as predicted by the TP hypothesis, and item 8 is placed at the bottom

because the TP hypothesis remains silent about it. The second column indicates the spatial relation sub-types, the third to fifth columns indicate the mean preposition, picture, and total scores for each test item. The translation scores are omitted because they were virtually the same as the picture scores. The sixth and seventh columns show the number of locative terms produced by participants in English and Japanese, which may serve as a partial index of translatability. Column eight represents the total number of English and Japanese locative terms used by the participants, which may be indicative of test item complexity and overall translatability.

Table 3. Preposition test scores (%) and locative terms

Test item	ST	Prep (M)	Pict (M)	Total (M)	ET	JT	Comp
1 apples on table	(i)	98.0	100	99.5	2	2	4
2 book on chair	(i)	100	100	100	1	2	3
3 bandaid on leg	(ii)	70.6	92.2	81.4	4	5	9
4 picture on wall	(iiia)	98.0	100	99.0	3	3	6
5 spiders on ceiling	(iiib)	82.4	84.3	83.4	4	2	6
6 house on river	(iv)	5.9	66.7	36.3	5	10	15
7 ring on finger	(vi)	27.5	96.1	61.8	5	3	8
8 sit in armchair	-	2.3	61.4	31.9	4	2	6

*Sub-type (ST); total mean scores for preposition (Prep), picture (Pict), and (Total); Total English (ET) and Japanese (JT) locative terms; and Complexity (Comp) = ET+JT.

Analysis of test item scores resulted in the following order: 2, 1, 4, < 5, 3 < 7

< 6, 8, where the differences between 4 and 5, 3 and 7, and 7 and 6 were significant, $\chi^2(1) = 5.51$, $p < .05$ (with Yates's correction), $t(50) = 3.74$, $p < .001$, and $t(50) = 4.50$, $p < .001$, respectively, while the differences between the other adjacent items were not significant. In terms of sub-type, the order is (i) = (iiia) < (iiib) = (ii) < (vi) < (iv). According to the TP hypothesis, the order is (i) < (ii) < (iii) < (iv) < (vi), whereas according to the CISD hypothesis, the order is (i) < (ii) = (iii) < (vi) < (iv). The result (vi) < (iv) is consistent with what the CISD hypothesis predicts but not with the TP hypothesis. The result that (iiia) < (iiib) and (iiia) < (ii) may appear inconsistent with both the CISD and the TP hypothesis and post hoc analysis is needed (see below).

Table 4 shows intercorrelations among preposition test scores and locative terms.

Table 4. The intercorrelations among preposition test scores and locative terms

	Prep	Pict	Total	ET	JT	Comp
Prep	-					
Pict	.83*	-				
Total	.99**	.90**	-			

ET	-.76*	-.56	-.74*	-		
JT	-.49	-.44	-.50	.53	-	
Comp	-.66	-.54	-.65	.77*	.95**	-

*$p < .05$, **$p < .01$.

There are seven significant correlations, but none of them are particularly remarkable; e.g., the significant negative correlation between preposition score (Prep) and the number of English locatives (ET) unsurprisingly indicates that the more difficult the prepositions, the more locative terms produced by the participants. On the other hand, it is rather disappointing that the number of Japanese locatives is associated neither with the prototypicality of image schematic relations nor with the number of the prepositions chosen although for item 6 a variety of locative terms were used in the translations. It is noted, however, that the correlation between preposition score (Prep) and the total number of English and Japanese locative terms used (Comp), -.66, approaches significance, $.05 < p < .10$, thereby suggesting that translatability is involved here, such that, the more difficult the translation is, the more variable the locative usage is, the lower the preposition score is. (With Item 8 excluded, the correlations between Prep and Comp and between Total and Comp become significant,

-.88, $p < .01$ and -.92, $p < .01$, respectively. Note that item 8 is not among the sub-types.).

4. Discussion

4.1. *Predictions and outcomes*

The main results show that the scores for the prototypical items 1 to 4 were not greatly different. The preposition scores appear to have reached ceiling levels. What differentiates the two hypotheses involved the non-prototypical items 6 to 8. The TP hypothesis predicts that Item 7 (*ring on finger*) is far more difficult than Item 6 (*house on river*), whereas the CISD hypothesis predicts that item 6 is more difficult than Item 7. The results support the latter. Item 6 is very difficult for JLEs with only 6% correct. As for item 8, the TP hypothesis is silent about Item 8, whereas the CISD hypothesis predicts that it is among the most difficult polysemous sub-types. Again, the result is consistent with the CISD hypothesis.

On the basis of the CISD hypothesis, the difficulty involving items 6, 7, and 8 is accounted for in the following way. For Item 6 (*house on river*), JLEs have only the

primary image schematic spatial relation for *on*, SUPPORT-FROM-BELOW, which also partially applies to the Japanese equivalent locative noun *ue*. Because the house at the edge of the river is not supported from below, many learners did not chose *on* but *at*, which is not ungrammatical but deemed not appropriate in this context. For Item 7 (*ring on finger*), the image schema is likely to be characterized not as canonical CONTACT but rather as less-canonical ORNAMENT or COVERING that can elicit *on*, but this image seems vague or ambiguous, resulting in only a performance of 28% correct. Of the remaining responses, *with*, which is most likely to co-occur with ornaments but ungrammatical in this context was 28%, and *of* was 24%, which suggests that the learners might have envisaged a PART-WHOLE relation between ring and finger. For Item 8 (*in armchair*), *on* was chosen 80% of the time, which obviously indicates that the learners took *armchair* as a family member of *chair*. In fact, although many pictures of the armchairs drawn consisted of armrests, they did not seem to evoke a CONTAINER image schema with a concave configuration; indeed, almost all armchairs they drew had flat seat plates plus armrests.

In regard to the prototypical items 1 to 5, the difficulty order predicted by the

TP hypothesis was 1, 2, 3, 4, 5, the prediction by the CISD hypothesis was 1, 2, 4, 3, 5, and the result obtained revealed 2, 1, 4, < 5, 3. A mention should be made concerning the apparently inconsistent finding that 4 < 5, i.e., (iiia) < (iiib) (picture on wall < spiders on ceiling) and 4 < 3, i.e., (iiia) < (ii) (picture on wall < bandaid on leg). The finding that 4 < 5 is against our prediction 4 = 5. The prediction that the ceiling level has been reached was not supported. The significant difference between these items seems to be attributable to the difference in the rotation of the LMs, i.e., the wall in item 4 is rotated 90 degrees whereas the ceiling in item 5 is rotated 180 degrees. Such a spatial rotation may be difficult even for adult learners. As for 4 < 3, 3 is similar to 7 in that both can be taken as bearing a canonical PART-WHOLE relation. The possible reason why 3 is much easier than 7 (70.6% vs. 27.5%) may be that the CONTACT-only relation for 3 is much simpler than the ENCIRCLEMENT-with-CONTACT relation for 7.

4.2. *Image schema based explicit instruction*

Once learners have acquired image schemas in L1, it seems almost impossible to spontaneously acquire the target image schemas in L2 classroom settings. This may be

the main reason why even advanced learners often fail to use English prepositions in non-prototypical contexts. Thus, explicit instruction is needed in L2 learning. The first step for learners should be to realize that L1 and L2 image schemas can be different and that prepositions just like content words are polysemous. The lower-intermediate level university students who participated in this study are proficient enough to understand explicit explanations about schematic image relations in English. In a classroom setting, the following explanations for items 6 to 8, with a few additional examples, should be sufficient to learn these items.

The example of Item 7 *ring on finger* shows the geometrical touching of surfaces and the functional feature of support. The wearing of necklaces, ties, bracelets, and clothes all fall under this category. Typical examples include *scarf on neck, bracelet on hand, tube on stick, wrapper on gum, bandana on head,* and *label on can.* Therefore, new image schema relationships that L2 learners have to learn include *ornaments or coverings on bodies or objects.*

For the sentence *there is a house on the river*, a number of separate semantic interpretations can be made (e.g., Lindstromberg, 2010: 51-54). In the prototypical, but

illogical conclusion in an ordinary context would be that the house is floating on the surface of the river. The figure TR has geometrical contact with the ground LM, and the ground provides functional support for the figure. For non-prototypical examples, *there is a house on [the edge of] the river* and *there is a house on <facing> the river*, the visual representations are exactly the same, however, the former emphasizes contact with the perimeter or edge of the body of water (cf. Lockwood, Lovett and Forbus, 2008). The latter example on the other hand indicates only the direction in which the house is facing. Other examples include *balloon on (the edge of) string, house on ocean*, and *handle on pan*. A new image schematic relation, which learners have to learn here, is *contact on the edge* (*contact without emphasizing support*).

As an extension of the CISD hypothesis, the use of *in* may also be included, as other forms of spatial relations are also possible candidates for inclusion subject to empirical verification. The prototypical spatial use of *in* shows a position of something or someone contained within an object or area. Generally, when depicting an enclosed or partially enclosed area, taking into account the relative size of the figure to ground (cf. Lautenschütz, Davies, Raubal, Schwering and Pederson, 2007), a gradual

perceptual transition is made from *on* the surface of the ground to *in* the ground, as illustrated by the *on* to *in* scalar representations by Gentner and Bowerman (2009: 269) and Lindstromberg (2010: 72-73). The comparative example used in this study, *sit on the chair* and *sit in the armchair*, illustrates this point exactly. When a figure is positioned on a flat surface with little notion of enclosure, the selection of *on* is overwhelmingly preferred. In the case of an armchair where the figure is partially surrounded by the ground, *in* is the appropriate preposition. Use of *on* in *the man is sitting on the armchair* conjures up an image of someone sitting on one of the arms of the chair or laying across the arms of the chair. While this usage is certainly possible, the likelihood of this condition is not high. The low accuracy response rates for this item by the participants of this experiment indicate that they require explicit instruction in the conceptualization of these figure TR to ground LM images. Explicit instruction in this case is relatively simple to explain. Where a flat surface area is likely to support the figure, *on* is appropriate. When the surface concavity begins to enclose the figure or when the figure penetrates the ground, *in* is selected. An extension of this feature includes wearing clothing, such as coat, hat, shirt, etc. (e.g., Mary is *in* a blue coat*;*

John *came in* a green hat).

5. Conclusions

The findings of this study indicate that the CISD hypothesis is more consistent in predicting the difficulty of non-prototypical sub-type usages than the TP hypothesis. Furthermore, the notion of *encirclement with contact at an edge* and *concave surfaces* were almost completely lacking in the participants of this study. Essentially, the TP hypothesis serves as the basic crosslinguistic universal hypothesis (that connects the frequency of semantic categorization to conceptual naturalness in L1 learning) against which we can propose language-specific hypotheses such as the CISD hypothesis, where the crosslinguistic differences in image schema for TR and LM account for their orders of difficulty in L2 learning. In particular, understanding the differences between L1 and L2 prototypical TR and LM features, translatability and metaphorizability will likely result in the development more successful explicit instruction. By proposing this empirically driven CISD hypothesis for L2 learners with different language backgrounds, continued effort will likely lead to further understanding of the difficulty

of prototypical, polysemous, and abstract usages of the spatial preposition *on*; with the goal to expand the focus of this research to other spatial adpositions in future studies.

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Footnotes

1. There are many linguistically unexpressed or half-expressed image schematic spatial relations. The English “raindrops on the window” half-expresses the location of raindrops whereas “raindrops on the outside of the window” fully expresses the spatial relation between raindrops and the window. By contrast, the equivalent Japanese translation is “*mado* (window) *no amatsubu* (raindrops)” (literally translated as “window’s raindrops”) does not express where raindrops are, which suggests that JLEs do not direct attention to the location of the TM in this condition even though the speaker/listener takes it for granted that raindrops are on the outside of the window.

2. The crack in the surface: English speakers easily view the surface as a thin but three-dimensional lamina, whereas JLEs always view it as a two-dimensional surface. It seems difficult for JLEs to metaphorically conceptualize a surface as three-dimensional. The literal translation, *surface no naka no crack*, sounds anomalous.