



A Study on the Acquisition of English Prepositions by Japanese EFL Learners: Influence of Prototypicality, Semantic Relations, Familiarity, and L2 Proficiency

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Previous studies have generally stated that L2 learners have difficulty mastering English prepositions with less prototypical meanings, while some studies have shown the opposite. This suggests that prototypicality may not necessarily be the only influence on learning English prepositions. The current study examined the acquisition of prepositions in, on, and at by Japanese EFL learners and further explored the impact of prototypicality, L2 proficiency, semantic relations (temporal, spatial, and abstract usages), and familiarity on prepositional knowledge. The results showed that L2 competence is essential to obtain prepositions in abstract usages. In addition, a negative correlation was found between prototypicality and accuracy. There was also a significant interaction between prototypicality and familiarity, where the lower the prototypicality, the greater the influence of familiarity on acquisition accuracy. A higher level of familiarity compensates for the difficulty of the extension meanings brought to them by the prepositions, which occurs in different L2 proficiency groups. The error patterns found in the study not only can help teachers understand the complex extensions acquired by Japanese EFL learners but also provide a clear view of the difficulty encountered in the process of acquiring English prepositions.

本研究の目的は、日本人英語学習者の前置詞in、on、atの習得に関わる要因の究明である。実験参加者には1)前置詞の空所補充、2)連語表現の親密度評価、3)英語熟達度テストといった三つのタスクに取り組んでもらった後、英語学習背景に関するアンケートに答えてもらった。前置詞空所補充タスクの得点を従属変数とした一般化線形混合モデルにより、前置詞と名詞の概念的関係性（空間関係、時間関係、抽象関係）、プロトタイプ性、前置詞と名詞のコロケーション親密度、および英語熟達度といった四つの要因の効果を分析した。また、日本人英語学習者に共通してみられる前置詞の誤用にはどのような特徴があるかを考察した。その結果、抽象関係にある前置詞を習得するには、L2の習熟度が不可欠であることが示された。また、プロトタイプ性と空所補充課題の得点には負の相関関係が見られた。プロトタイプ性とコロケーション親密度との交互作用は有意であり、プロトタイプ性が低いほど、親密度の影響が大きくなることが明らかとなった。本研究が示す学習者の誤用パターンは、前置詞の習得難易度に関わる要因について示唆を与えるだけでなく、学習者がどのように前置詞の意味の拡張を習得していくかを理解するのにも貢献する。

Keywords: second language acquisition, prepositions, EFL, prototypicality, semantic relations



Introduction

Prepositions are essential components of learning English as an additional language and serve as crucial structural markers for sentences (Morrow, 1985), while L2 learners display continuous fluctuations and generate various types of prepositional errors during the language learning process (Bong, 2013; Heydari & Bagheri, 2012; Lee et al., 2020; Nurhamidah, 2021; Satake, 2020). Due to the semantic polysemous nature of English prepositions, L2 learners encounter difficulties in acquiring different senses of prepositions (Lorincz & Gordon, 2012). Previous studies have shown that English word collocations containing prepositional phrases are among the most frequent usage errors produced by speakers of English as an additional language (e.g., Tetreault & Chodorow, 2008), with some common misunderstandings such as the wrong distinction between particles and prepositions (Haugh & Takeuchi, 2022; Kweon, 2007). A study by Hamzah (2012) revealed that errors in prepositional usage amounted to 12.31% and ranked fourth among the 14 most frequent categories of errors made by L2 learners. Generally, some common types of errors were identified in learners' production, including insertion, omission, addition, and inappropriate use of prepositions (e.g., Hamzah, 2012; Nurhamidah, 2021). The results of previous corpus-based research also indicated that English prepositions such as *in*, *on*, *of* and *at* are the most frequently produced by learners in both written and spoken English (e.g., Nghi & Phuc, 2022; Suzanne, 2017; Tetreault & Chodorow, 2008). Meanwhile, prepositions including *on*, *in*, and *at* are challenging to learn in light of their usages in a variety of contexts, both for representing place and time (Bong, 2013). The systematic review by Damayanti and Sundari (2022) also highlighted the misuse of prepositions caused by prepositional polysemy.

The concept of prototypicality has been extensively utilized in the analysis of syntactic and lexical phenomena, with a broad definition positing that certain lexeme within a set exhibit greater typicality than others (Karimi, 2018; Stukker & Sanders, 2012). In the context of English prepositions, the theory of prototypicality postulates that prepositions possessing polysemic meanings are presumed to encompass both prototypical and less prototypical senses. Consequently, the learning difficulty of certain prepositions may vary due to the disparate degrees of their prototypical characteristics (Hayashi, 2001, 2008; Yamaoka, 1996). Learners of English as an additional language demonstrate a propensity to employ English prepositions with higher prototypicality (Bong, 2011; Hayashi, 2008).

Nonetheless, prototypicality may not be the sole determinant significantly influencing the acquisition of prepositions. The semantic relation, encompassing spatial, temporal, and abstract usages, which pertain to the polysemous attributes of the prepositions, may also exert an influence on the acquisition process of prepositions by L2 learners, particularly those prepositions that can be articulated under these three relations (Ajami, 2022; Alhammad, 2023; Richard-Bollans et al., 2023). It has been posited that English prepositions primarily denote spatial meanings between two physical entities (Tyler & Evans, 2003), implying that learners typically acquire the spatial meanings of prepositions prior to abstract or temporal meanings (Kemmerer, 2005). Consequently, the abstract meanings of prepositions may pose challenges for learners in accurately comprehending prepositions within sentences (Falck, 2018).

Previous studies have underscored the inherent challenges faced by native Japanese speakers in learning English prepositions, with L1 interference emerging as a predominant factor (Bong, 2011; Kaneko, 2008; Shimada & Nagano, 2017). Unlike English, Japanese lacks prepositions and instead employs a linguistic category known as postpositional particles (Moser, 1970). According to Shimada and Nagano (2017), the Japanese postpositional particle *ni* can correspond to multiple English prepositions, including *on*, *for*, *at*, *in*, and *to*, depending on different contexts. The complexity of various usages of English prepositions resulted in negative language transfer among Japanese learners of English. As a result, they may encounter sustained difficulty in learning prepositions, particularly those characterized by polysemous natures and diverse meanings to describe time and position (Cho, 2010). To delve deeper into the acquisition of prepositions with polysemous features by Japanese learners of English, the current study has chosen *in*, *on*, and *at* as the target prepositions, given their extensive range of usages and definitions in specific sentence contexts.

Literature Review

Prototypes of the Prepositions *in*, *on*, and *at*

Regarding the polysemous natures and prototypical meanings of English prepositions, Dirven (1993) first proposed that the definition of English prepositions could extend beyond physical space to encompass mental space. As the meanings of English prepositions undergo various extensions, the concept of prepositions evolves into more abstract senses to a certain extent. This has been further investigated by Radden and Dirven (2007), providing empirical evidence for the localistic theory that English prepositional meanings can be systematically classified into three primary relations: temporal, spatial, and abstract.

Rice (1996) further analyzed the prepositional prototypes and confirmed that there were indeed prototypical semantic values for English prepositions *in*, *on*, and *at*, all of which primarily convey spatial meanings. Notably, Rice also highlighted the challenges in characterizing the abstract uses of prepositions, and other prepositions more easily substitute them. The need for further exploration to discern both the similarities and differences among various prepositions has been emphasized.

The Prototype Theory holds that ambiguity inherent in prepositions can be elucidated through the analysis of prototypical meanings. It further postulates that all non-prototypical meanings are deemed to be related to the prototype, usually by an extension (Lindstromberg, 1991). Consequently, the polysemous nature of prepositions can be interpreted via these prototype meanings. This was mentioned later by Lindstromberg (1996), who proposed another statement saying that each preposition may possess a limited number of pertinent literal meanings, with a propensity towards the formation of mental prototypes.

Extension of Prepositions *in*, *on*, and *at*

Dirven (1993) proposed extensions of prototype meanings of several commonly used English prepositions from spatial source domains via the domain of time to the more abstract target domain. The following figures show the network of extensions of prepositions *in*, *on*, and *at*.

As shown in Figure 1, with respect to the preposition *on*, the spatial meaning of contacting with a line or surface and supported by things by touching physical objects was considered the most prototypical sense, extending to the temporal usage of time and other senses such as states or reason.

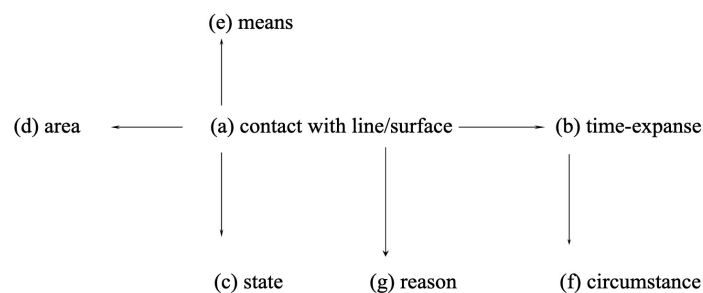


Figure 1. Radial network of extensions of *on*. Adapted from “Dividing up physical and mental space into conceptual categories by means of English prepositions” by R. Dirven, in C. Zelinsky-Wibbelt (Ed.), *The semantics of prepositions: from mental processing to natural language processing* (p. 78), 1993, Mouton de Gruyter. Copyright 1993 by Walter de Gruyter & Co., D-10785 Berlin.

The basic meaning of the preposition *in* refers to the physical description of locations or enclosing space, followed by the expression of indicating a period (e.g., *in one week*). The meaning of enclosure was also extended to psychological senses (e.g., *in despair*), accompanying abstract meanings such as cause or means (see Figure 2).

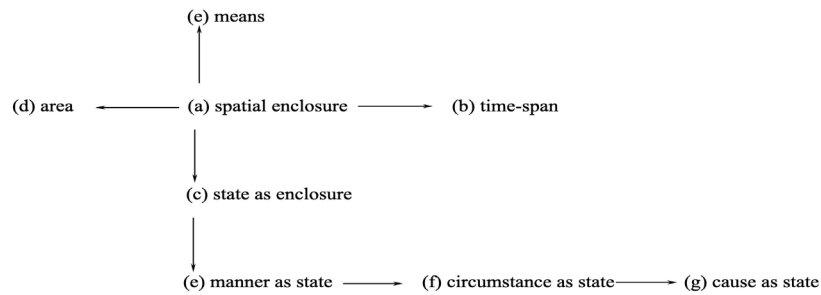


Figure 2. Radial network of extensions of *in*. Adapted from “Dividing up physical and mental space into conceptual categories by means of English prepositions” by R. Dirven, in C. Zelinsky-Wibbelt (Ed.), *The semantics of prepositions: from mental processing to natural language processing* (p. 79), 1993, Mouton de Gruyter. Copyright 1993 by Walter de Gruyter & Co., D-10785 Berlin.

The preposition *at* has the central meaning of pointing to a place or location (e.g., *at the office*), followed by the description of the time span (e.g., *at 6 o'clock*) and further extended into senses such as causal relationship or manner (see Figure 3).

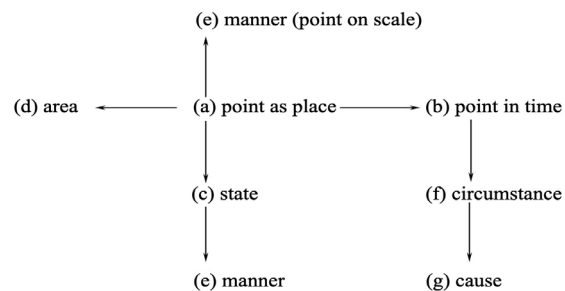


Figure 3. Radial network of extensions of *at*. Adapted from “Dividing up physical and mental space into conceptual categories by means of English prepositions” by R. Dirven, in C. Zelinsky-Wibbelt (Ed.), *The semantics of prepositions: from mental processing to natural language processing* (p. 77), 1993, Mouton de Gruyter. Copyright 1993 by Walter de Gruyter & Co., D-10785 Berlin.

Radden and Dirven (2007) further stated that the core of the prototypicality meaning of these three prepositions was spatial, while temporal and abstract meanings were derived from the spatial meaning. Consequently, spatial usage seems to be the prototypical meaning of most prepositions.

It is worth mentioning that Chavarría (2002) classified English prepositions *on*, *in*, and *at* according to their polysemous features and semantic networks. Here are the categories from the most prototypical usages to the least prototypical uses of these three prepositions (Chavarría, 2002, pp. 61-69):

1. *ON* having a line/surface configuration, establishing a spatial relationship from one point to another, which can either be a one-dimensional object or represent a two-dimensional area. *On* implies objects touching each other. This relationship can be given on a horizontal or non-horizontal surface. *On* can be used with spatial but not surface elements. *On* is also used as a preposition of 'time when' with an abstract meaning (see Table 1).

TABLE 1
Prototypicality of the Preposition 'on'

Prototype	Feature	Sample sentence
Most prototypical use	+ surface element	Put your signature on this line
	+ horizontal element	
	+ touching objects with roads, bridges, and routes	She lives on Canal Street
	+ surface element	The child wrote his answer on the board
+ non-horizontal element		
Least prototypical use	+ touching objects	We saw some apples on the tree
	+ surface element	
	+ attached objects	She came on her bike despite the rain
	for most modes of conveyance: large vehicles which imply the condition of being 'in transit,' as well as for two-wheeled vehicles and animals used for transportation.	I saw him on T.V
	for most audio and video equipment	The train didn't arrive on time at the station
	point of time	She was born on July 20, 1974
	for dates and for days of the week	

2. *IN* establishes an area or volume configuration, establishing a spatial relationship of one point to another that is three-dimensional. The area should be conceived as an enclosed space. *In* can also take a two-dimensional object. It may also be used to indicate a specific point in time (see Table 2).

TABLE 2
Prototypicality of the Preposition 'in'

Prototype	Feature	Sample sentence
Prototypical use	to indicate a relationship point area/volume, where one object is within the confines of another object in an enclosed space	The child put the piece of glass in his pocket.
	with objects indicating a relationship point-area, where one object is within the confines of the other, but not implying the meaning of container	The strange man was standing in the doorway
	with small, four-wheeled-motor vehicles	I saw him in his new car
	to indicate periods of time with months/years	We visited Peru in October
	to indicate a time within a larger period of time	I will try to be here in the morning

3. *AT* establishes a spatial relationship of one point to another that represents a dimensionless location, a mere point in relation to which the position of an object can be indicated. *At* can also indicate points of time. *At* shows such a broad range of uses that it is difficult to identify its prototypes (see Table 3).

TABLE 3
Prototypicality of the Preposition 'at'

Prototype	Feature	Sample sentence
Most prototypical use	to indicate the location where an activity takes place, but does not specify any surface or area relationship among the objects involved	The concert was at the university
	to refer to a building in its institutional or functional aspect	She must be at the office now
Least prototypical use	to indicate a precise place	The Flee Market is at the corner of Seventh and Elm
	to indicate a precise time that has previously been mentioned	At that time, he was only five years old
	to indicate clock time	I will meet you at one o'clock

The authors took advantage of Chavarría's (2002) study as a reference to classify the prototypicality ratings of target prepositions and applied them to the current study. Characteristics have been summarized from the least prototypical meaning to the most prototypical meaning (see Table 4).

TABLE 4
Prototypicality Rating of the Target Prepositions

Group	on	in	at
Least prototype	- physical + attached objects	n/a	- dimension - location - time + precise position
Less prototype	+ point of time + duration	- dimension + abstract	+ time + duration
More prototype	+ contact + concreteness + support	+ point of time + duration	+ status + direction
Most prototype	+ contact physical + touching objects + specific position	+touching objects + location + dimension	+ location - surface element - touching objects

L2 Learners' Acquisition of Prepositions

Cognitive approaches to the acquisition of English prepositions have piqued the interest of many researchers. With the advent of Prototype Theory, Yamaoka (1996) initially examined how Japanese EFL learners acquire the preposition *on* and proposed that prototypicality is correlated with the acquisition of English polysemous words by L2 learners. Senses that deviate from prototypes pose learning challenges, and the degree of deviation affects the level of difficulty. To deepen learners' comprehension of various prototype meanings, Yamaoka advocated for equal emphasis on both prototypical and less prototypical meanings when teaching prepositional knowledge in L2 classrooms. These findings were subsequently scrutinized by Hayashi (2001), who investigated the acquisition of English prepositions *in* and *on* by Japanese EFL learners, following the framework of prototypicality. By classifying the target prepositions into three different levels according to the level of extension, Hayashi found that the frequency with which participants chose *in* and *on* was related to the extension of the prepositions. Japanese learners of English exhibited a decreasing frequency of correct choices in light of the extent to which the meanings of *on* and *in* were extended. In other words, less prototypical senses are more challenging to acquire than the prototypical ones. However, this study did not examine whether the frequency of correct choices by the participants was associated with their level of L2 proficiency. Furthermore, it remained unclear which prepositional extensions were easier for Japanese EFL learners to acquire. Hayashi (2008) reiterated this point in a subsequent study that explored the acquisition of English prepositions *in*, *on*, and *at* by native Japanese, considering the influences of prototypicality and language transfer. Owing to their divergent perceptions and understanding of the extension of preposition meanings, Japanese learners of English displayed differential acquisition patterns compared to native speakers. The results indicated that the prototypical meanings of the preposition *on* tended to be the easiest for Japanese learners to acquire. Additionally, Hayashi (2008) pointed out that the level of proficiency of L2 learners might differentially impact the acquisition of these prepositions. Although Hayashi categorized the polysemous meanings of the target prepositions into four groups in this study, he did not specify which prototype meanings were more misleading or underdeveloped for L2 learners.

Similarly, Kodachi (2005) investigated the productive skills of Japanese and Filipino learners in terms of their acquisition of the prepositions *in*, *on*, and *at* within different semantic networks, aiming to identify the most frequently produced meanings by the learners. The findings revealed that spatial usages were predominantly ranked higher than abstract and temporal usages. However, given the similarity in the

frequency of sentences produced for both spatial and temporal usages, it appears challenging to equate the temporal usage with the prototypical meaning of the target preposition in participants' minds.

Bong (2013) further investigated the acquisition of prepositions by Japanese and Korean learners of English and found that EFL learners generally had higher accuracy when dealing with prepositions in temporal relation, followed by the usage of spatial relation. Furthermore, in relation to Korean English learners, the overall results showed that they performed better on some of the items assumed to be less prototypical senses than on more or the most prototypical ones. This unexpected finding indicated that for English prepositions such as *at*, prototypical senses may not necessarily be more accessible to acquire than less prototypical ones. Therefore, he suggested the meaningfulness of further exploring different semantic features in determining the degree of difficulty or development patterns of acquisition. Bong (2013) also stated that L2 learners performed even better in cases where certain prepositions were considered to have less prototypical senses. This indicates that prototypicality may not necessarily be the only influence on the acquisition of prepositional skills of learners, suggesting that future research could explore the impact of other variables on the prepositional knowledge of Japanese EFL learners.

So far, the acquisition of prepositions by Japanese learners of English has been investigated only to a limited extent. Taferner (2016) examined the influence of prototypical features on intermediate-level Japanese EFL learners' knowledge of different polysemous usages of the preposition *to*. By comparing the performance on the pre-test and post-test, participants showed a significant improvement in the post-test for temporal and spatial usages. In contrast, there was a lower level of achievement in abstract usages. The findings revealed the challenges that abstract usages pose to learners. Meanwhile, Taferner (2015) proposed the idea that the level of English proficiency seems to play a crucial role in acquiring explicit knowledge of prepositions and that the effect varies for learners with different levels of proficiency. These findings highlighted the importance of comparing the performance of prepositional acquisition of learners with different levels of English proficiency in one study, suggesting an agenda for future research.

A recent study conducted by Taferner and Yamada (2020) examined the acquisition of prepositions *in* and *on* in the context of spatial usages by Japanese learners of English. It was surprising to find that Japanese learners encountered difficulty in correctly applying these two prepositions, particularly when describing vehicles for transportation (e.g., ___ a boat) as well as contact with objects (e.g., ___ the chair). Although spatial usage was categorized as the core of prototypical meaning, the similarity of the two prepositions when applied to describe the same relationship between two entities could potentially pose challenges for learners. This observation underscores the fact that more prototypical senses may not necessarily be easier for learners to grasp compared to less prototypical senses. Therefore, future research should consider exploring other factors that coexist with prototypicality and influence learners' acquisition of prepositions.

Another factor that cannot be ignored is the impact of input frequency on the acquisition of prepositions (Jach, 2018). Frequency plays an essential role in language acquisition and development (Demuth, 2007; Durrant, 2008). Previous studies have investigated the relationship between frequency and second language acquisition from various perspectives, including but not limited to collocation, vocabulary, grammar, and more (e.g., Demuth, 2007; Ellis, 2013; Kartal & Sarigul, 2017), and found that frequency positively influences the acquisition of L2 knowledge. During the learning process, learners are inclined to generate usages that they encounter more frequently (Crossley et al., 2016). Mueller (2011) conducted a study on English learners' understanding of prepositions and indicated that frequency-based mechanisms play a vital role in specific areas of acquisition, which could potentially be applied to the understanding of grammatical patterns and the process of L2 acquisition for semantically complex forms, such as prepositions. Thus, if learners have sufficient familiarity with certain usages of prepositions, in other words, with a high frequency of both input and output, will they perform well regardless of the prototypical meanings?

Overall, although previous studies have focused on the acquisition of prepositions in the framework of cognitive semantics and investigated any of the three usages (e.g., Aajami, 2022; Boieblan, 2023; Pan & Hu, 2022), there is still a lack of direct comparisons regarding learners' acquisition of prepositions across all semantic relations (i.e., temporal, spatial, and abstract usages) in one study. Previous studies have shown

that Japanese learners of English continuously face problems when acquiring prepositions, whereas the influence of prototypicality on the acquisition of learners with different proficiency levels remains controversial. Moreover, it is also significant to look further into the impact of frequency across different levels of L2 proficiency, the relationship between prototypicality and familiarity, and whether differentiation will be found under different semantic relations and prepositions. This study aims to fill a gap in the literature on the acquisition of prepositions *in*, *on*, and *at* by Japanese learners of English and provide insight into the difficulties that native Japanese speakers may encounter when learning English prepositions with polysemous features.

The current study will address the following research questions:

RQ1: Will Japanese EFL learners perform better with prepositions under prototypical senses or less prototypical senses?

RQ2: Will different levels of L2 proficiency influence the acquisition of prepositions by L2 learners under different semantic relations?

RQ3: Is there a significant relationship between learners' performance and their familiarity with the usages of the target prepositions?

Methodology

Participants

This study involved 30 native Japanese speakers, comprising 11 males and 19 females. All participants were undergraduate students at a Japanese university, with ages ranging from 18 to 23 years ($M = 20.6$). Half of the participants commenced their English language learning at the age of seven. The remaining participants began learning English between the ages of ten and twelve, with the exception of three individuals who were exposed to English at the age of two. All participants received a standard English education in Japan, and four participants had years of experience studying in English-speaking countries. The duration of English language study among the participants varied, ranging from 7 to 19 years.

Instruments

Background questionnaire

A background questionnaire was used to collect demographic information from participants and their self-reported English proficiency. The items incorporated in the questionnaire were derived from the Language Experience and Proficiency Questionnaire (Marian et al., 2007). To facilitate comprehension, the questionnaire was made available in both English and Japanese versions.

English proficiency test

To determine the level of English proficiency of the participants more accurately, both authors agreed to use another proficiency test so that both data would compensate each other. In this case, the British Council Online English level test was applied to the current study, which included 25 multiple choice questions. This test was chosen in the current study for several reasons. First, this test assessed participants' understanding of English grammar, vocabulary, and phrasing, which provides a more comprehensive overview of participants' English proficiency. Meanwhile, after each question, participants were asked to assess their confidence that their answer was correct by selecting three options: *certain*, *fairly sure*, and *not sure*. This ensured that the results were more reliable, as it prevented some participants from accidentally

choosing the correct answer when they did not know the answer. Moreover, after completing the test, the website automatically classified participants' English proficiency into three levels: pre-intermediate, intermediate, and upper-intermediate to advanced.

Fill-in-the-blank test

A fill-in-the-blank test was assigned as the primary test to examine L2 learners' knowledge of the target prepositions. Test items were adopted from previous studies (Bong, 2011; Gitsaki, 1999; Hayashi, 2008; Kodachi, 2005), resulting in a total of 81 test items in the current study (Cronbach's $\alpha = .87$). Regarding the extension of prototypicality, this study followed the definition of Chavarría (2002) as a reference to classify the prototypicality rating of the target prepositions, thus assigning a rating from 1 (least prototypical) to 4 (most prototypical) to each test item (except for 'in,' which only had three rating levels). A pilot study was conducted with six participants who speak English as an additional language. The final version of the test was completed based on their feedback. Three native English speakers (nationality: USA) confirmed the plausibility of the test items.

Familiarity rating task

A familiarity rating task was implemented to assess the participants' familiarity with the prepositional usages that were presented in the preceding fill-in-the-blank test. The items in the familiarity rating task corresponded directly to the test items in the fill-in-the-blank test. Participants were provided with a 7-point Likert scale, complete with descriptions. On a scale from 1 (not familiar) to 7 (very familiar), participants were required to evaluate each item based on the degree of their agreement.

Procedure

An experiment flyer was posted online to recruit participants. Participants were paid 1,500 yen for a time commitment of 90 minutes. Those who consented to participate in this study initially signed the consent form, followed by the completion of the background questionnaire.

Subsequently, Zoom meetings were scheduled with each participant separately. Participants first read the instructions and undertook the fill-in-the-blank test, which required approximately 40 minutes for completion. After a 5-minute break, participants entered the experiment program again and completed the familiarity rating task, which necessitated approximately 20 minutes. Finally, they navigated to the official website of the British Council Online English Level Test and devoted about 15 minutes to the English proficiency test.

Data Analysis

Data were analyzed by using Generalized Linear Mixed Effects Models (GLMM) via R version 4.1.0. The dependent variable is the accuracy of the fill-in-the-blank test. Regarding independent variables, the fixed effects are: 1) prepositions; 2) L2 proficiency; 3) familiarity rating; 4) semantic relations; and 5) prototypicality. Participants (the corresponding ID number) and items (81 items in the fill-in-the-blank test) were considered random effects.

Results

English Proficiency Test

Within the cohort of 30 participants, the scores exhibited a range from 58 to 86 ($M = 71.16$, $SD = 6.42$) out of 100. Based on their performance and the data procured from the background questionnaire, participants were divided into two groups: the intermediate group ($N = 18$) and the pre-advanced group ($N = 12$).

Familiarity Rating Task

Table 5 shows that, in the context of this study, participants exhibited greater familiarity with the usage of the preposition *in* when used in temporal relation. Conversely, the least familiarity was observed with the usage of the preposition *on* when used in abstract relation.

TABLE 5
Descriptive Statistics of Familiarity in Different Prepositions and Relations

Group	Number	Mean	SD
at	810	5.33	1.76
in	810	5.59	1.64
on	810	4.92	1.91
abstract	810	4.54	1.92
spatial	810	5.61	1.65
temporal	810	5.71	1.55

Statistical Analysis through Generalized Linear Mixed-effects Model

Before building the model, variables that included numeric factors were converted into z-score. To find the best-fitting model, all possible interactions with variables were arranged according to the hypotheses. By comparing all models through *ANOVA* and the value of Chi-Square tests, model 8 was found to be the best-fitting model (see Table 6). It includes fixed effects: prototypicality, familiarity rating, relation, proficiency, correct answers, and three interactions: the interaction between prototypicality and familiarity, the interaction between proficiency and relation, and the interaction between proficiency and correct answers. Random effects in this model are random intercepts for participants and items, as well as the by-item random slope for familiarity.

TABLE 6
GLMM Model of Accuracy

Formula:
accuracy~prototypicality.z*familiarity.z+proficiency.z*relation+proficiency.z*CorrectAns+(1|id)+(1+familiarity.z|item), dat=data1, family="binomial"
Number of obs: 2430, groups: item, 81; id, 30

Fixed effects	Estimate	Std.Error	z value	Pr (> z)	
(Intercept)	0.22968	0.29268	0.785	0.432597	
prototypicality.z	-0.49696	0.18915	-2.627	0.008606	**
familiarity.z	0.96738	0.08411	11.501	<2e-16	***
proficiency.z	0.29069	0.14346	2.026	0.042733	*
relationspatial	1.59708	0.44864	3.560	0.000371	***
relationtemporal	1.17647	0.32211	3.652	0.000260	***
CorrectAns	-1.25988	0.32134	-3.921	8.83e-05	***
CorrectAnson	-0.74085	0.31685	-2.338	0.019378	*
prototypicality.z:familiarity.z	-0.30734	0.07669	-4.008	6.13e-05	***
proficiency.z:relationspatial	-0.24587	0.13628	-1.804	0.071210	.
proficiency.z:relationtemporal	-0.23897	0.13863	-1.724	0.084746	.
proficiency.z:CorrectAns	0.27205	0.13338	2.040	0.041390	*
proficiency.z:CorrectAnson	0.26656	0.13490	1.976	0.04816	*

Note. Significant.codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '.' 1

As shown in Figure 4, participants achieved the highest accuracy in spatial relations. Compared to spatial ($M = 0.73$, $SD = 0.49$) and temporal ($M = 0.69$, $SD = 0.46$) relations, it was much more difficult for participants to acquire prepositions under the abstract relation ($M = 0.43$, $SD = 0.5$).

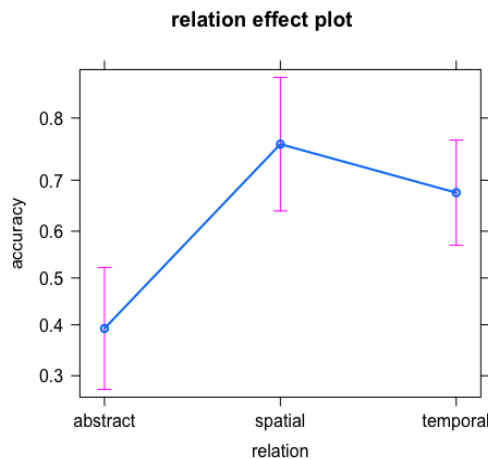


Figure 4. Relation effect of accuracy in the fill-in-the-blank test.

Figure 5 revealed that, within the scope of this study, the preposition *in* was more readily acquired compared to *at* and *on*. This may be attributable to the high scores in the familiarity rating that participants reflected in the use of the preposition *in* (mean = 5.59, see Table 5). This resulted in the highest accuracy rate for this preposition, as already demonstrated in Table 6 that the effect of familiarity was statistically significant ($p < .001$).

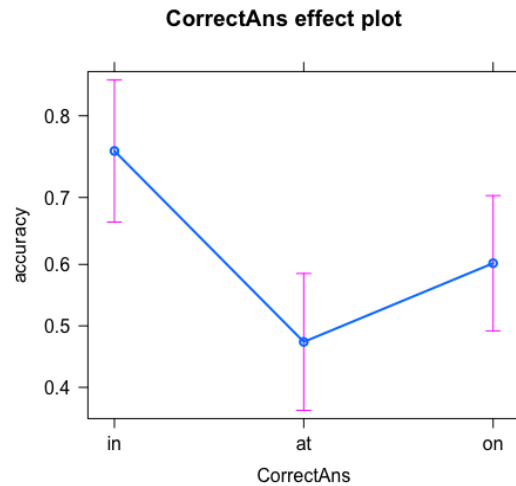


Figure 5. Accuracy of target prepositions in the fill-in-the-blank test.

A negative correlation was observed between prototypicality and accuracy, as depicted in Figure 6. Participants demonstrated superior performance on items classified as least or less prototypical, while they had lower accuracy rates on items classified as more prototypical. However, a statistically significant interaction was identified between prototypicality and familiarity ($p < .001$). As illustrated in Figure 7, the influence of familiarity on accuracy is well articulated for the less prototypical items. Conversely, familiarity did not exert as much influence on items with higher prototypicality as it did on items with lower prototypicality. In other words, for items deemed less prototypical or least prototypical, a higher degree of familiarity compensated for the complexity of extension meanings presented to L2 learners. It can be concluded that even though target preposition usages were classified as less prototypical or least prototypical, higher degrees of familiarity could guide participants towards correct answers. The majority of participants may be familiar with the use of target prepositions in extension meanings, thereby achieving higher accuracy rates. This also suggests that mental frequency exerts a positive influence on the acquisition of prepositions by Japanese learners of English.

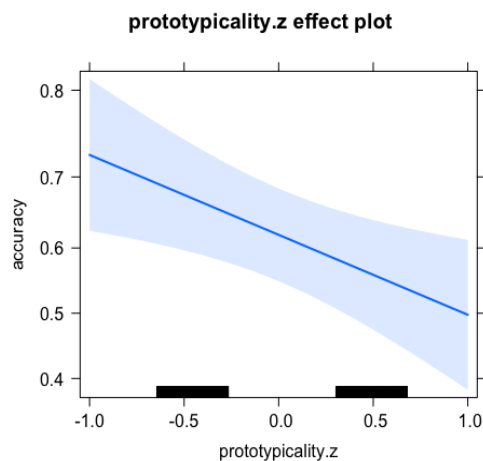


Figure 6. Prototypicality effect of accuracy in the blank-filling test.

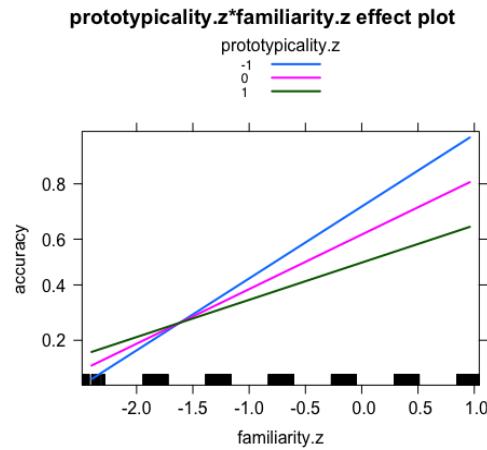


Figure 7. Interaction between prototypicality and familiarity.

A marginally significant interaction ($p = 0.071, p = 0.084$) was found between proficiency and relations. As shown in Figure 8, the abstract relation exhibited the lowest accuracy score. However, the impact of L2 proficiency on accuracy was most pronounced in this relation, indicating substantial development. This suggests that participants with higher L2 proficiency also performed better on items of abstract meaning, whereas those with lower L2 proficiency rarely answered correctly in the context of abstract usage. On the other hand, when compared to the abstract relation, the slopes of the spatial and temporal relations were significantly different. To verify the effect of L2 proficiency across different relations, we changed the reference level of relations and preposition to assess the significance of L2 proficiency. The results demonstrated that the influence of L2 proficiency on accuracy was significant for the abstract usage across all three prepositions. This effect was also significant under temporal and spatial relations in the case of *on* and *at*. Therefore, variations in L2 proficiency among participants did not significantly influence their acquisition of prepositions in spatial and temporal usages only in the case of *in*. In essence, from the perspective of relations, L2 proficiency played a pivotal role in understanding the abstract meaning.

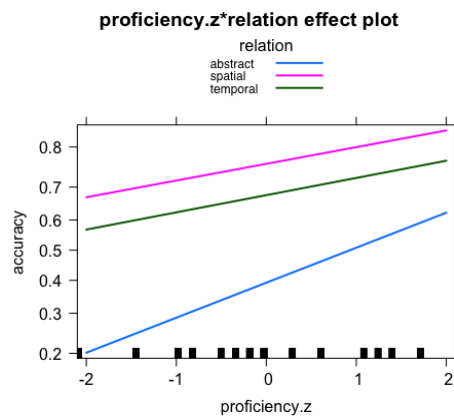


Figure 8. Interaction between proficiency and relations.

The interaction between proficiency and target prepositions was found to be significant ($p = 0.0413, p = 0.0481$). The preposition *in* tended to be the easiest to acquire, and the impact of proficiency on accuracy was not substantial (see Figure 9). However, the influence of proficiency on accuracy was more pronounced for the prepositions *on* and *at*. Furthermore, significant differences were observed between *in* and *at*, as well as between *in* and *on*. The usages of the preposition *in* appeared to be well-mastered by the majority

of the participants, and different levels of English proficiency did not significantly affect the difficulty of acquiring this preposition. On the other hand, English proficiency played an essential role in the acquisition of the other two prepositions, indicating that the usages of the prepositions *on* and *at* presented distinct challenges in acquisition, contingent on the participants' L2 proficiency.

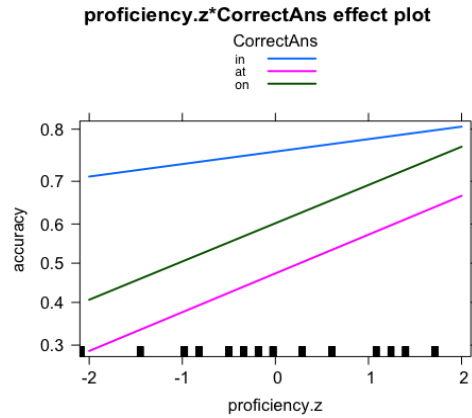


Figure 9. Interaction between proficiency and correct answers.

Regarding the error patterns produced by participants, the most prevalent error identified in the fill-in-the-blank test was substitution. This was closely followed by the omission of prepositions and misinterpretation of the target sentences. A selection of representative test items and corresponding error patterns for each preposition are enumerated. Table 7 presents the accuracy of participants' responses and the error patterns associated with the preposition *on*.

TABLE 7
Response and Error Patterns of the Preposition 'on'

Relation	Prototype	Target example	Accuracy (N = 30)	Error patterns			
				at	in	others	omission
Spatial	most	girl on my father's right	8 (26.6%)	3 (10%)	5 (16.6%)	13 (43.4%)	1 (3.3%)
	most	put signature on this line	20 (66.6%)	0	8 (26.6%)	2 (6.6%)	0
	more	distance seems much smaller on the map	11 (36.6%)	0	6 (20%)	13 (43.3%)	0
temporal	less	graduated from university on May 6th	20 (66.6%)	6 (20%)	4 (13.3%)	0	0
	less	bought souvenirs on the voyage	8 (26.6%)	2 (6.6%)	9 (30%)	11 (36.6%)	0
abstract	more	homework is on page 86	12 (40%)	2 (6.6%)	3 (10%)	4 (13.3%)	9 (30%)
	least	a puzzled expression on his face	23 (76.6%)	1 (3.3%)	2 (6.6%)	4 (13.3%)	0
	least	taking on the phone	19 (63.3%)	0	0	11 (36.6%)	0

Afterward, the accuracy of participants' answers and error patterns of the preposition *in* are shown in Table 8.

TABLE 8
Response and Error Patterns of the Preposition 'in'

Relation	Prototype	Target example	Accuracy (N = 30)	Error patterns			
				at	on	others	omission
Spatial	most	concealed transcript in the mailbox	26 (86.6%)	0	2 (6.6%)	2 (6.6%)	0
	less	high pitch in section 8	20 (66.6%)	3 (10%)	5 (16.6%)	2 (6.6%)	0
temporal	more	My mother is in her forties	25 (83.3%)	3 (10%)	0	1 (3.3%)	1 (3.3%)
	more	get married in five years	18 (60%)	0	0	12 (40%)	0
abstract	more	invented in the 21st century	25 (83.3%)	0	2 (6.6%)	3 (10%)	0
	less	talk to me in Japanese	29 (96.6%)	0	0	1 (3.3%)	0
	less	sit in a circle	19 (63.3%)	0	9 (30%)	2 (6.6%)	0

As previously noted, participants displayed the highest accuracy in the acquisition of the preposition *in*. In general, participants achieved relatively high accuracy rates in the usage of spatial and temporal relations. Nevertheless, it was observed that they committed more errors when items conveyed the meaning of locations in written texts. This also mirrors the challenges they encountered in the acquisition of *on*.

Next, the accuracy of participants' responses and error patterns of the preposition *at* are shown in Table 9.

TABLE 9
Response and Error Patterns of the Preposition 'at'

Relation	Prototype	Target example	Accuracy (N = 30)	Error patterns			
				in	on	others	omission
spatial	most	at the bottom of the page	16 (53.3%)	6 (20%)	4 (13.3%)	4 (13.3%)	0
	more	look at the TV screen	17 (56.6%)	0	0	13 (43.3%)	0
	least	the house is at the corner of Walmart	15 (50%)	7 (23.3%)	5 (16.6%)	2 (6.6%)	1 (3.3%)
temporal	less	at the age of seven	25 (83.3%)	2 (6.6%)	0	3 (10%)	0
	less	come home at lunchtime	16 (53.3%)	6 (20%)	3 (10%)	5 (16.6%)	0
	less	departed at eighty-second intervals	10 (33.3%)	11 (36.6%)	4 (13.3%)	5 (16.6%)	0
abstract	least	I laughed at his joke	26 (86.6%)	0	0	4 (13.3%)	0
	least	The dog is at its happiest	5 (16.6%)	17 (56.6%)	0	6 (20%)	2 (6.6%)
		laptop was sold at a price of...	21 (70%)	1 (3.3%)	2 (6.6%)	6 (20%)	0

As mentioned previously, participants gained the lowest accuracy rate when acquiring the preposition *at*. Various reasons were found that led to the formation of errors. Firstly, most of the participants made mistakes by substituting *in* or *on* in the blanks. They also failed to fill in the target preposition *at* due to

different understandings of the meaning of the sentences. For example, in the item ‘*look at the television screen*’, participants responded *for* instead of *at*, which also made the sentence grammatically correct but changed its original meaning. From this, we could deduce that as for participants who failed to fill in the target preposition in this sentence, *look for* seemed to be a more frequent type of collocation than *look at* so participants first came up with the preposition *for* here.

Discussion

The findings showed that participants achieved the highest accuracy on test items categorized as spatial usages (see Figure 4). This aligns with the statement by Tyler and Evans (2003), in which the core prototype meaning of the target prepositions is spatial; thus, spatial usage appears to be more readily acquired by L2 learners. Abstract usage, on the other hand, is considered an extension of meaning in English prepositions, thereby appearing less commonly compared to other relations. Therefore, learners may encounter difficulties in acquiring prepositions under abstract relations, and target prepositions may be easily substituted by others. This is consistent with previous studies stating that abstract usages typically express the most complicated meanings and pose the greatest challenges for learners to master (e.g., Falck, 2018; Taferner, 2016).

Additionally, a negative correlation was observed between prototypicality and accuracy, with participants demonstrating superior performance on items with less prototypical meanings. This appears to contradict the conclusion drawn by Hayashi (2008) yet aligns with the findings of other studies (e.g., Bong, 2013; Taferner & Yamada, 2020), indicating that L2 learners of English performed better even with instances presumed to be less prototypical than the more prototypical ones. The results imply that prototypicality may not be the exclusive factor influencing the acquisition of English prepositions by EAL speakers. At the same time, a significant interaction was detected between prototypicality and familiarity in relation to accuracy ($p < .001$). The lower the prototypicality, the more substantial the impact of familiarity on the accuracy of prepositional acquisition. The significant interaction between familiarity and prototypicality appears to address the query previously posed by the authors, underscoring the importance of input and output frequency on learners’ prepositional knowledge. In the present study, most items categorized as less prototypical were considered high-frequency collocations for participants. The heightened familiarity of participants compensated for the complexity of extended meanings introduced by prepositions. As long as participants’ familiarity was sufficiently high, the target prepositions could be accurately filled in, irrespective of the extension of prototypical meanings. Thus, the degree of prototypicality is not necessarily the only determinant of preposition acquisition by Japanese learners.

Pertaining to the influence of English proficiency on the acquisition of prepositions, L2 proficiency played an essential role in acquiring the three prepositions only in the context of abstract usages. Participants possessing higher levels of L2 proficiency performed better on the usage of abstract relations in this study, with the impact being significant.

The findings of error patterns produced by participants unveiled factors that interfered with their acquisition of prepositions. With respect to the preposition *on*, most participants erred by substituting it with *in* or *at*, potentially due to the analogous meanings between spatial and temporal usages. Besides, misinterpretation of sentence meanings led participants to insert incorrect prepositions. For instance, in the sentence ‘*The distance seems much smaller on the map*’, participants demonstrated relatively low accuracy, with 13 of them incorrectly using *than* instead of *on* (see Table 7). This is likely attributable to the preceding word ‘smaller’ (comparative adjective), which prompted their misjudgment to use *than*, given that appending ‘than’ after a comparative is a common rule. However, it appears that due to the complexity of L2 grammatical usages, the majority of participants failed to comprehend the entire sentence, resulting in the incorrect usage of this preposition. Another noteworthy point is that participants may still commit errors on items deemed low-frequency, even if the test items share the same usages or exhibit more prototypical meanings (e.g., *The girl on my father’s right is my sister*). In summary, participants exhibited insensitivity

to the usages of the preposition *on* that convey the meaning of written texts or printed objects, irrespective of different semantic relations.

Another intriguing finding is that participants exhibited varied performance in sentences, even though the meaning of the test items remained consistent. As illustrated in Table 8, the overall accuracy score for the item ‘talk to me in Japanese’ was 96.6%, while the accuracy for the item ‘speak in a gentle voice’ was merely 46.6%. However, the usage of the preposition *in* in both sentences signifies ‘to show the language or material used’. The outcomes of the familiarity rating task disclosed that the item ‘talk to me in Japanese’ had considerably lower familiarity, yet most participants with higher L2 proficiency responded with the correct answer. In this case, L2 proficiency was more likely to contribute to the accuracy of the primary test, which corroborated the hypothesis proposed by Taerner (2015).

Moreover, all participants failed to provide the correct answer for the item “*worked hard at her marriage*”. Among all the incorrect responses, over half of the participants filled in the blanks with the preposition *for* instead of the target preposition, rendering the sentence grammatically correct as well. The lower accuracy for this item could be attributed to the fact that *for* appears to be more commonly used by speakers of English as an additional language compared to *at* (according to the responses of native English speakers in the confirmation procedure, *at* was also frequently used). In this context, *for* represents ‘*a goal or sake*’, while *at* denotes ‘*status in a relationship*’. However, even if there exists an alternative correct response to this question, it was scored as “incorrect” when the response did not align with the intended preposition *at* in this study. In summary, the usages of *at* proved to be the most difficult for Japanese learners of English to acquire, given the varying semantic relations and degrees of prototypicality.

Conclusion

In this study, the acquisition of three prepositions by Japanese EFL learners was examined. Generally, learners encounter difficulties in acquiring the target English prepositions from various perspectives. A common error identified was their inability to distinguish the meaning of ‘*location in written texts*’ in the usages of all three prepositions, likely due to their similar senses. Consequently, although the results indicated that prepositions under abstract relations posed the greatest challenge for participants to master in this study, it is still imperative for teachers to emphasize students’ ability to acquire prepositions in the contexts of spatial and temporal meanings. Furthermore, it has been found that participants’ performance was notably inconsistent in instances where the same usage type was applied to different sentences (e.g., ‘*My roommates often talk to me in Japanese*’/‘*The professor speaks in a gentle voice*’). This suggests the necessity to instruct learners on different prepositional patterns, despite the usage meaning being identical.

L1 interference may also lead to the misinterpretation of target prepositions. For example, the sentence ‘*There is a high pitch in section 8*’ is translated as ‘第8節「に」、ハイピッチがある’ in Japanese, while the sentence ‘*We learned the concept of psychology in chapter 4*’ is translated as ‘第4章「で」、心理学の概念について学んだ’ in Japanese. The corresponding postpositions in Japanese differ. Hence, Japanese learners of English may experience difficulties when acquiring the usages of *in* here due to the influence of L1 interference. This could provide an additional explanation for participants’ production of errors in specific uses. Therefore, language teachers are encouraged to initially consider the potential interference caused by students’ L1 when learning English prepositions, thereby formulating targeted teaching plans and elucidating crucial knowledge that is frequently misconstrued by L2 learners.

Meanwhile, the current study is subject to several limitations. Primarily, the number of participants was limited. Only 30 participants were successfully recruited to participate in this study during the pandemic. Secondly, an imbalance was observed in the number of participants across the two proficiency groups, with the pre-advanced level comprising fewer participants (N=12). Another limitation pertains to the potential for multiple correct answers for the item “*worked hard at her marriage*”, which also made the sentence grammatically correct but converted the sentences to a different meaning of usage. Although participants

failed to fill in the blanks with the target preposition in this case, we cannot directly assert that they did not master these usages. It is plausible that these usages were simply less frequent in the participants' minds. To deal with this issue, it is recommended that future research design test items to have only one correct answer based on the sentence's meaning, thereby avoiding biased results.

Prepositions may be an aspect that is easily overlooked by learners in foreign language learning. For native Japanese speakers, the absence of prepositions in their native language may lead to persistent difficulties in discerning the meanings of certain prepositions in sentences. Given the challenges identified in this study faced by native Japanese speakers in learning English prepositions, it is suggested that L2 teachers adopt appropriate approaches to teach prepositions, tailored to individual needs and class characteristics. This could potentially facilitate learners in gaining a more profound understanding of different prototypical senses and semantic relations in English prepositions. Future research could also explore and compare the effects of various pedagogical approaches on learners' acquisition of prepositional knowledge.

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Appendix A: Fill-in-the-blank Test

Please fill in the blank with the appropriate English preposition. Write 'x' if you think one is not required.

- He has a degree ____ Chemistry.
 The girl ____ my father's right is Jane.
 My grandmother's house is ____ the corner of the Walmart.
 Normally, children start primary school ____ the age of seven.
 Akari and Nomura are talking ____ the phone.
 Newton discovered the universal gravitation ____ the year 1666.
 There is a textbook ____ the table.
 Daria usually feeds the cat ____ the garden.
 Give your friend directions ____ the use of your computer game.
 See you guys ____ Friday morning.
 They live ____ Atlantic Avenue.
 He passed his history test but failed ____ math.
 His homework for tomorrow is ____ page 86.
 I think there is someone ____ the front door.
 The dog is ____ its happiest when the owner feeds it food.
 Since the school was next to my house, I used to come home ____ lunchtime.
 He used to play the piano ____ weekends.
 In the competitive business world, one has to be perfect ____ communicating with customers.
 His father speculated that he would get married ____ five years.
 Alex concealed his transcript ____ the mailbox.
 I've got skills ____ the use of new Macbook.
 There are some grapes ____ the tree.
 Max wants to become an actor ____ some point.
 We waved ____ the staff to try to get the bill.
 I was listening to music ____ the radio.
 Natsume was a lecturer ____ English literature.
 Water vapor freezes ____ the windows.
 He graduated from Harvard University ____ May 6.
 We might go somewhere ____ the end of the holiday.
 Put your signature ____ this line ____ the bottom of the page.
 England and Scotland were united ____ 1707.
 She has worked hard ____ her marriage.
 ____ my childhood, my brother was competent ____ singing.
 My father brought a watermelon ____ a hot afternoon in August.
 It never snows here even ____ winter time.
 Peter put the coins ____ his pocket.
 The meeting was ____ the president's office.
 Professor Frank is ____ New York this week.
 The laptop was sold ____ a price of \$1500.
 Teachers always still work ____ night.
 The student is writing the answer ____ the blackboard.
 ____ arriving home I found the door was unlocked.
 We learned the concept of psychology ____ chapter 4.
 Matthew has been ____ the library for two hours.
 The cashier has a puzzled expression ____ his face.
 The check is still ____ the envelope.

The textbook is ____ the bookshelf.
Mr. Smith's flight leaves ____ noon.
I will see you ____ Sunday.
I laughed ____ my brother's joke.
The flowers will bloom ____ spring.
She took a quick glance ____ her reflection.
Jackson played a tune ____ his guitar.
He paid for the toy car ____ cash.
I'm looking ____ the television screen.
The professor speaks ____ a gentle voice.
My roommates often talk to me ____ Japanese.
Matthew bought a lot of souvenirs ____ the voyage.
We will meet ____ Peter's house tomorrow.
He got his driver license ____ three months ago.
The teacher is hard ____ his students.
The film will start ____ 9 o'clock.
Iphone 11 was invented ____ the 21st century.
I do not have any cash ____ me.
John studied hard ____ the beginning of this semester.
There was an expensive jacket ____ the shop window.
Let's have a party ____ Thanksgiving Day.
My father was ____ the dentist when I called him.
There is a high pitch ____ section 8.
The country is still ____ war.
The distance seems much smaller ____ the map.
The children sit ____ a circle.
Christmas is ____ December 25th.
Snow leopards are ____ risk of extinction.
My mother is ____ her forties.
The best Chinese restaurants is located ____ Tokyo.
Trains departed ____ eighty-second intervals.
You can get me ____ 081-2239-9431.
They are standing ____ the top of the stairs.

Appendix B: Classifications of the Meanings of Prepositions

Classifications of meanings of *on*

Relation	Meaning	Illustrative item	Prototypicality level
Temporal	simple time slot	see you <u>on</u> Friday morning	Less prototype
	use to specify a day, date, or occasion	graduated from university <u>on</u> May 6	
	refers to a specific time period	brought a watermelon <u>on</u> a hot afternoon in August	
	Immediately after something has happened to	<u>on</u> arriving home I found the door was unlocked.	
	show something during a time	bought souvenirs <u>on</u> the voyage.	
	express time of particular date or holiday	let's have a party <u>on</u> Thanksgiving Day.	
Spatial	location of sth/sb at, near, or next to sth/sb	the girl <u>on</u> my father's right	Most prototype
	position, location of sth/sb to a particular place/thing/person	live <u>on</u> Atlantic Avenue	
	inside places or written texts	put your signature <u>on</u> this line	

	on the surface of..	some grapes <u>on</u> the tree	Least prototype
	refers to a supporting surface or entity	Water vapor freezes <u>on</u> the windows	More prototype
	indicate an object in contact with or supported by a surface	a textbook <u>on</u> the table.	
	specify objects on which something is written, painted, or printed	The distance seems much smaller <u>on</u> the map.	
Abstract	as using audio or video equipment/method	Akari and Nomura are talking <u>on</u> the phone.	Least prototype
	shows that something has happened to someone	Give your friend directions <u>on</u> the use of your new computer game.	
	in the possession of someone	I do not have cash <u>on</u> me.	
	someone's face shows a particular expression	The cashier has a puzzled expression <u>on</u> his face.	
	reflects on giving phone number	You can get me <u>on</u> 081-2239-9431.	
	show sth is affected by someone/sth	The teacher is hard <u>on</u> his students.	
	refers to written texts	His homework for tomorrow is <u>on</u> page 86.	
	shows skills that are used as a method	Jackson played a tune <u>on</u> his guitar.	More prototype

Classifications of meanings of *in*

Relation	Meaning	Illustrative item	Prototypicality Level
Temporal	during part or all of a period of time or an event	Newton discovered the universal gravitation <u>in</u> the year 1666.	More prototype
	Period when something persists or happens (in the future)	he would get married <u>in</u> five years.	
	refers to a specific time point	England and Scotland were united <u>in</u> 1707.	
	particular time period	<u>in</u> my childhood.../ <u>in</u> Spring...	
	show the general time or time period	iPhone 11 was invented <u>in</u> the 21 st century.	
	show a range of how old someone is	she is <u>in</u> her forties.	
Spatial	simple position/ inside a place or area	feed the cat <u>in</u> the garden	Most prototype
	simple position	conceal transcript <u>in</u> the mailbox	
	sth happens or in a place	Professor Frank is <u>in</u> New York this week.	
	be located in	be located <u>in</u> Tokyo	
	sth in a book, speech, or picture...	We learned the concept of psychology <u>in</u> chapter 4.	Less prototype

Abstract	as involved or connected with a particular subject or activity	a degree <u>in</u> Chemistry	Less prototype
	refers to sth that is done as a result of something else	He passed his history test but failed <u>in</u> math.	
	indicates a profession or specialization within the profession	a lecturer <u>in</u> English literature	
	involved or connected with a particular subject or activity	My brother was competent <u>in</u> singing.	
	specifies the form of something such as the amount of money	paid for the toy <u>in</u> cash	
	shows the language or material used	speaks <u>in</u> a gentle voice	
	describes a particular form or shape	sit <u>in</u> a circle	

Classifications of meanings of *at*

Relation	Meaning	Illustrative sentence	Prototypicality level
Temporal	denotes a particular time when somebody does something	children start primary school <u>at</u> the age of seven	Less prototype
	refers to a particular period of time during something happens	I used to come home <u>at</u> lunchtime	
	specific time clock when sth happens	The film will start <u>at</u> 9 o'clock	
	something happens according to a particular rate	Trains departed <u>at</u> eighty-second intervals.	
	shows sth happens in a period of time	<u>at</u> the beginning of this semester	
Spatial	express location or arrival in a particular place or position	My grandmother's house is <u>at</u> the corner of the Walmart.	Least prototype
	location in space	someone <u>at</u> the front door	Most prototype
	refers to places in texts	<u>at</u> the bottom of the page	
	position, sth happens in somewhere	The meeting was <u>at</u> the president's office.	
	indicate a place or location where someone stays	Matthew has been <u>at</u> the library for two hours.	

	in the direction of something	look <u>at</u> the television screen	More prototype
Abstract	undergo an emotion	The dog is <u>at</u> its happiest.	Least prototype
	ongoing activity (a skill)	One has to be perfect <u>at</u> communicating with customers.	
	shows glance, laugh, look, rejoice...	She took a quick glance <u>at</u> her reflection.	
	shows the situation that sth is in/ ongoing state or situation	<u>at</u> war / <u>at</u> risk	
	expresses a particular price or level	The laptop was sold <u>at</u> a price of \$1500.	
	shows the thing that caused an action or feeling	I laughed <u>at</u> my brother's joke.	
	Behavior/direction action	waved <u>at</u> the staff	More prototype
deal with, try to achieve	work hard <u>at</u> one's marriage.		