A Study of Prototype Formation of the Meanings of Prepositions by Japanese and Filipino Learners of English from the Perspective of Cognitive Linguistics

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Abstract

The purpose of this study is to investigate how Japanese and Filipino learners of English, who have different first language (L1), understand the meanings of English prepositions and form the semantic networks of them.   In this study, we investigated "at" "in" and "on" as our target prepositions from two perspectives: the perspective of the prototypicality and the one of the influence of learners' L1.   The reason for this choice is that, as Hayashi (2001) pointed out, they are among the most basic prepositions and, accordingly, have basic senses and many extended senses.   This makes them ideal for studying the influence of prototypicality.   Further, concerning especially their spatial usages, these prepositions are thought to have rather fixed Japanese equivalents when translating.   On the other hand, in Tagalog, all of these three prepositions are translated into the general locative marker, *sa* (see Himmelamann (2004)).   Since there are such differences between their L1s on the usages of prepositions, we assumed that learners' L1 affects when they acquire the meaning of the prepositions.   In this study, the following hypotheses were examined.

1) There are some differences of the formation of prototypical examples of prepositions, "at", "in", and "on", between Japanese and Filipino learners of English.

2) Learners' L1 affects the formation of prototypical examples and learners' lexical knowledge of prepositions of L2. Therefore, it is difficult for them to understand the usages correctly.

1. Introduction

In the field of lexical acquisition, the acquisition of English prepositions is one of the current topics (see Rice et al., 1995; Rice, 1996; Hayashi, 2001; Cho, 2002; for example), although it had not been investigated in the past as much as other lexical items.   Since 1973, as Taylor (1993) pointed out, when Jackendoff (1973) could write that "people seem never to have taken prepositions seriously" (pp.345), not only have prepositions played a significant role in Jackendoff's own subsequent works but also in the researches by many linguists and L2 researchers in the past two decades.

In this study, we will deal with "at," "in" and "on" as our target prepositions to investigate. The reason for this choice is that they are among the most basic prepositions and they have various meanings (Leech, 1969; and Hayashi, 2001).   The purpose of this study is to investigate how learners of English understand the meanings of the target prepositions.

We will investigate the target prepositions from two viewpoints. One is the prototype effect in learners' mind for understanding their meanings.   The other is to look at some relationship between English and learners' mother tongue or their L1.

We have three groups as subjects: Japanese high school students who have low proficiency of English, Japanese university students who are in the intermediate level of English, and Filipino university students who have high proficiency of English.　Second, sentence structures of their L1 are completely different from those of Japanese.　One of the viewpoints of this study is on the effect of learners' L1.　In order to examine this effect, we should have two groups who have different L1s.

2. Analysis of the Usages of Prepositions as Polysemous Words

2.1. The Semantics of Prepositions

A great amount of research has been done on the semantic factoring of English prepositions (e.g., Bennett, 1975; Jackendoff, 1987; Ikeno, 1996; Leech, 1969; and Rice, 1996; Rice et al., 1995; etc.).　As Tanaka (1987, 1997) pointed out, essentially, prepositions have a function to relate the values X and Y semantically, on the functional structure such as P (X, Y).　By doing so, prepositions express the spatial relations between the values X and Y.　Here, the concept *space* has a variety of sub-concepts such as locative, temporal, psychological and social.　Some researchers such as Bennett (1975) advocated *localistic theory*, which is about the relationship between the sub-concepts of the concept of space.　According to this theory, the centre of the relation is locative space, and other sub-concepts are derived from it as Figure 1 shows.

Physical space ———— Quasi-physical space (e.g., *in the train*) ———— Social Space / Psychological Space / Temporal Space
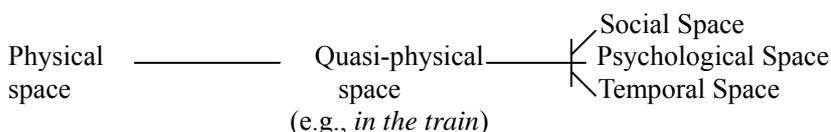
Figure 1.　The relation between the sub-concepts of the concept of space on the localistic theory
(Source: Tanaka, 1987, pp.333)

Based on the core meaning theory, the cognitive processing of the functional structure in this localistic theory stays constant.　In the next section, we will consider the core meaning of our target prepositions, "at," "in" and "on."

2.2. The Core of the Prepositions "at," "in" and "on"

Tanaka (1987) defined the core meaning of our target prepositions as in Table 1.

Table 1.　The Core of Our Target Prepositions

Preposition	at	in	on
Core	"Place" itself →[-space] [-flat space]	"Space"	X touches surfaceY →[+surface] [+contact]

The prototypical meaning of each preposition, as a best exemplar of the usages of it, and its various usages are derived from the core.　We will consider the prototypical meaning of each target preposition in the next section.

2.3. Prototypes of the Prepositions "at," "in" and "on"

Prototype approach is pervasive among the studies in the acquisition of English prepositions. It starts from Bennett (1975).   In localistic theory, three types of meanings are considered as meanings of prepositions; namely, spatial, temporal, and abstract.   He claimed that the centre of the meaning is spatial, and the other two meanings are derived from the spatial meaning.   Since then, many researchers, including L2 researchers, theoretically consider temporal and abstract relations as extensional usages of spatial relations.   Take Dirven (1993) for example.   In his theory, the extensions of meaning of prepositions from space via time into more abstract domains (pp.76) follow a certain path and do not occur in a haphazard way, as shown in the Figures 2 (as for the case of "in" and "on," see Dirven, 1993).   That is, the spatial usage, which is the easiest meaning to show the relationship between the trajector and the landmark, is the prototypical meaning of our target prepositions.


Note. a) point as place: e.g.) *at the station*   b) time-point: *at six o'clock*
         c) state: *at work*   d) area: *good at guessing*
         e) manner: *at full speed*   f) circumstance: *at these words (he left)*
         g) cause: *laugh at, irritation at*
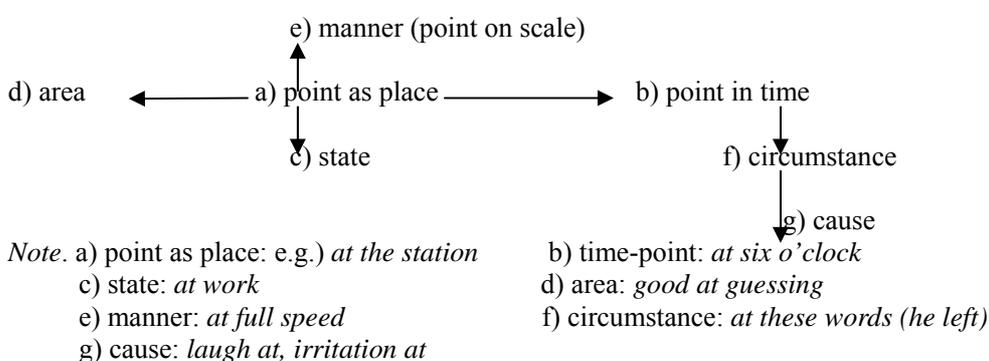
Figure 2.   Radial network of extensions (in the case of "at," Source: Dirven, 1993, pp.77)

Dirven takes Lakoff's *radial network*[1] as his background, and he defined locative meaning as a prototype of each preposition.   Ikeno (1996) and Rice (1996), however, experimentally investigated this claim, and found that the locative meaning was not necessarily the prototype for other meanings.   Rice (1996) suggested, based on her findings, that "at the least, in case of 'at,' 'on' and 'in', we are dealing with a minimum of two central reference points, a spatial one and a temporal one" (pp.159).   Based on this research, Cho (2002) pointed out the possibility that native speakers of English recognise temporal meaning and spatial meaning differently.   From these results, Cho raised the questions below.

    A. What is the mental reality of the L2 learners like?
    B. Is it sufficient to only investigate the acquisition process of the spatial usages of
       prepositions?
These questions will be considered more in the following sections.

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[1] Lakoff (1987).

2.4. L1's Constraint for the Acquisition of the Meanings of Prepositions by Japanese Learners of English

So far, we examined the core and prototypical usages of our target prepositions "at," "in" and "on" as polysemous words. And in the discussion, Cho (2002) raised questions about the prototypical meaning of our target prepositions, namely, whether or not spatial usage is only the prototypical meaning of prepositions. In order to examine these questions, we will consider the constraints of learners' L1, which is considered to affect the acquisition of the meanings of polysemous words and formation of their prototype.

Several studies of L2 lexical acquisition have been done in the framework of learners' L1's constraints. There are many studies on Japanese learners of English's acquisition of English prepositions. Tanaka (1983, 1997) found that Japanese learners of English show a strong tendency to search for a one-to-one correspondence or direct translation equivalent in Japanese. As these researches pointed out, *-no naka (ni/de)* corresponds to "in," *-no ue (ni/de)* to "on," and *-ni/de* to "at." Therefore, as a result of one-to-one correspondence, we are able to assume that Japanese learners of English consider the spatial usage as prototypical meaning of each preposition. On the other hand, as Tanaka (1987) pointed out, it has some negative effects for Japanese learners of English trying to acquire the usages of the prepositions. In the following sections, we will consider these effects.

2.4.1. The Difference of Viewpoints

As we have seen above, Japanese learners of English have a strong tendency to apply the word *-no naka (ni/de)* as a result of one-to-one correspondence or direct translation to the preposition "in." It leads the prototypical meaning of this preposition as the three-dimensional space that has clear physical boundaries, as in (1).

> (1) John wa tento *no naka ni* iru.
>
>> John is *in* the tent.

However, as Tanaka (1983) pointed out, the one-to-one correspondence is not always applied. For instance, in (2), the one-to-one correspondence is not applied between "in" and *-no naka (ni/de)*.

> (2) Taiyo wa higashi *kara* noboru.
>
>> The sun rises *in* the east.

In this example, Japanese learners of English tend to use the preposition "from," affected by direct translation into Japanese. It is because of the difference of viewpoints between Japanese and English speakers. In this case, people consider in English *the east* as a field where sun rises, while, Japanese people take *higashi* as a starting point of rising of the sun. For this reason, one-to-one correspondence sometimes has a negative effect on Japanese learners of English acquiring the meaning of a preposition, that is, it restricts the range of the meanings.

2.4.2. Overextension of the Meanings

As we have seen in section 2.2, the core meaning of "on" is defined as [+surface] and [+contact], and its prototype is [+horizontal surface], affected by its Japanese counterpart *-no ue (ni/de)*.   In the case of "on," this correspondence often leads the overextension of the meanings.   According to Yamaoka (1995), while the core meaning of "on" is as [+surface] and [+contact], in the case of *-no ue (ni/de)*, it is *higherness*.   He pointed out that higherness of *-no ue (ni/de)* in Japanese simply indicates a higher positional relationship one item keeps to the other irrespective of any semantic relations which can co-occur with this feature; for example, contact, coverage, disconnected-higherness, etc.   In contrast, these semantic relations are encoded by different prepositions in English.   Take (3) and (4) for example.

(3) Watashi wa hei *no ue ni* aru ki no eda wo mita.
     I saw the branch *over* the fence.
(4) Hikouki ga umi *no ue wo* tonde iru.
     A plane is flying *above* the sea.

In these examples, the relation between two items is a higher positional one.   Therefore, Japanese learners of English tend to use "on" as a counterpart of *-no ue (ni)*.   However, in (3), the relation between two items is *coverage*, and in (4), the relation is *disconnected higherness*.   In English, different prepositions are used for these cases: "over" to (3) and "above" to (4), instead of "on."   Although it is a mistake, as Yamaoka pointed out, to assume that every usage of each of these English prepositions can be expressed with *-no ue (ni/de)*, we are able to say that *-no ue (ni/de)* covers a prototypical part of the semantic field that these prepositions --- on, over, above --- respectively cover, and it causes learners' mistakes.

2.4.3. The Difference in the Way of Spatial Representation between Japanese and English

So far, we have found that one-to-one correspondence to the meanings of English prepositions has a positive effect on Japanese learners of English learning the prototypical meanings of the prepositions; however, it also has negative effects on them, such as to restrict the range of meanings or to lead the overextension of the meanings.

Likewise, the Japanese correspondence to "at" is *-ni*.   When we try to translate *–ni* into English, it is not always the case that "at" applies to its English counterpart.   Take (5) and (6) for example.

(5) Watashi wa kinou jibun no ie *ni* ita.
     I stayed *at* my house yesterday.
(6) Watashi wa kinou kare no ie *ni* itta.
     I went *to* his house yesterday.

Although both of the sentences have the same Japanese particle *-ni*, the translations in English of these particles are different.   It is because of the difference of the way of spatial representation

between Japanese and English[2]. In the case of "in" or "on," these Japanese counterparts, *-no naka (ni)* or *-no ue (ni),* are composed of [N +*no*+<spatial noun>+*ni*]. By using spatial nouns, we are able to express the relationship between two values. However, the Japanese particle *ni* itself does not have a function to express the spatial relations. It is not until *ni* has a spatial noun before it that it can express the spatial relations. For that reason, we cannot connect *-ni* to "at" as its only counterpart.

2.5. Basic Grammar of Filipino and the System of Prepositions in Filipino
2.5.1. Basic Sentence Patterns and Markers

According to Himmelmann (2004), the basic sentence pattern of standard Filipino consists of [verb + subject]. In the formal usage, subject is fronted as [subject + verb], and in this case, the marker *ay*, which means fronting, is put after the subject[3]. There is no correspondence in Filipino to the English verb *be*. Instead, the marker *si* before person's name expresses the subject as in (7a).

(7a) Hapones   si   Saito.   (Saito is Japanese.)
     Japanese   P.Sg.Sb   Saito
(7b) Saito   ay   si   Hapones. (Saito is Japanese.)
     Saito   Fr P.Sg.Sb   Japanese

2.5.2. Major Verbal Alternations

Like many other Western Austronesian languages, Filipino verbs exhibit an elaborate set of morphological distinctions. The two major distinctions are voice and aspect. The voice system of Filipino consists of at least four voices (Himmelmann, 2004, pp.17): Actor voice, patient voice, locative voice, and conveyance voice. Each voice is marked by different affix(es), and the focused noun is marked by the markers. Actor voice is marked by the infix *–um-* or the prefixes *mag-* or *man-*, patient voice by the suffix *–in*, locative voice by the suffix *–an*, and conveyance voice by the prefix *i-*. Verbs consist of a root + these affix(es). Hereafter, we will take the actor voice, which is the most basic verb, as our example. The conjugation of Filipino verbs does not depend on tense but on aspect. There are also four aspects: Infinitive, perfective, imperfective, and irrealis. The concept of the tenses (past, present, future, etc.) is expressed with other temporal words. Conjugations of actor-voice verbs are listed in Table 2.

Table 2. Conjugations of Actor-voice Verbs (*-um-* verbs)

	Root	Infinitive	Perfective	Imperfective	Irrealis
1)	uwi (to go back)	um-uwi	um-uwi	um-u-uwi	u-uwi
2)	kain (to eat)	k-um-ain	k-um-ain	k-um-a-kain	ka-kain

Note. 1) = verbs start from vowel, 2) = verbs start from consonant

When we make infinitive and perfective aspects, we put *um* before the root as the prefix for

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[2] The detailed explanation of the difference is in Tanaka and Matsumoto (1997).
[3] The meaning of each abbreviation is explained in the list of abbreviations (See Appendix A).

type 1).　For type 2), we put *um* between the first consonant and vowel, as the infix.　As for the imperfective aspect, type 1), put *um* as prefix, and repeat the vowel at the beginning of the root. For type 2), put *um* as infix between the first consonant and vowel of the root, and repeat the root. Lastly, when we make irrealis, repeat the vowel at the beginning of the root for type 1).　For type 2), repeat the first syllable (consonant + vowel).

(8) Intransitive verb sentence (V+S)
　　　T-um-a - takbo　　　ang　　　bata.
　　　AFX(IPF)　R(to run)　N.sg,sb　　boy
　　　　(The boy runs.)
(9) Transitive verb sentence (V+O+S)
　　　B-um-a -basa　　　　　ng　　　　aklat　　ang　　　bata.
　　　AFX(IPF) R(to read)　N.Sg.DO　book　　N.Sg.Sb　boy
　　　　(The boy reads a book.)

2.5.3. Locative Marker *sa* as a Preposition

　　　The marker *sa*, which leads indirect objects in Filipino, corresponds to English prepositions. It also corresponds to the Japanese particles *-ni* or *-e*.　It leads not only the locative nouns but also the temporal nouns.　When it comes before the temporal nouns, the forms of it change depending on the aspect of the verb.　With the perfective aspect, the marker *noon,* which means the past tense, is used instead of *sa*.　With all other aspects, the marker *sa* is used, and we distinguish the tense by the conjugation of the verb.　In Filipino, we can make other prepositional phrases with *sa* + other particular conjunctions; for example, para (= for) sa = for, tungkol (= about) sa = about, etc.

(10) Pu　　-punta　　si　　　Taro　*sa*　Maynila　　*sa*　　　Linggo.
　　　AFX(Ir)　R(to go)　P.Sg.Sb Taro　LOC　Manila　　TM(ft)　Sunday
　　　　(Taro will go *to* Manila *on* Sunday.)
(11) P-um-unta　　　　　　si　　　Taro　*sa*　　　Maynila　*noon*　Linggo.
　　　AFX (PFX)　R(to go)　P.Sg.Sb Taro　LOC　　Manila　　TM(pt)　Sunday
　　　　(Taro went *to* Manila (*on*) last Sunday.)

2.6. The Difference of L1 Constraint between Japanese and Filipino

　　　So far, we have seen the constraint of learners' L1 acquiring the meanings of English prepositions, from the viewpoint of the usage of correspondence to English prepositions in each L1. Table 3 shows the correspondences of particles in three languages.

Table 3. Correspondences of Particles in Three Languages

	English	Japanese	Filipino
Space	at<in<on	-ni/-de	sa
		-no naka (ni/de)	
		-no ue (ni/de)	
Time	at<in<on	-ni	sa
			(present/future)
			noon (past)

In English prepositions, all of our target prepositions are used to express space or time, but

Native speakers of English distinguish the meanings with different prepositions; "at," "in" and "on," in each usage.   In Japanese spatial particles, we distinguish these meanings with different spatial nouns such as *-no naka (ni/de)* or *-no ue (ni/de)*.   It corresponds to the distinction of spatial usages of English prepositions.   However, as for the Japanese time particles, there is no distinction of meanings as with English prepositions.

On the other hand, there is no distinction of spatial usages in the Filipino marker *sa*; however, the temporal usages have a distinction of tenses, which is different from the distinction of temporal usages of English prepositions.

In the following experiment, the constraints of learners' L1 on acquiring the meanings of English prepositions as polysemous words, which have been considered so far, will be examined.

3. Experiment

3.0. Research Questions

With the background mentioned in the previous sections, this study focuses on the following questions:

1) What are the prototype meanings of our target prepositions for Japanese and Filipino learners of English?   Are there any differences between Japanese and Filipino?   Is temporal usage also a prototypical meaning for them?
2) How learners' L1 affects the construction of the prototypes of the meanings of our target prepositions?

3.1. Preliminary Analysis: Meanings of our Target Prepositions

Before going to the experiment, we investigated the meanings of each target preposition, "at," "in" and "on," with the three most famous English-English dictionaries for ESL learners: Longman Dictionary of Contemporary English, Oxford Advanced Learners' Dictionary, and Collins Cobuild English Dictionary.   We also took the example sentences from the ones in these dictionaries.   As a result, 17 meanings were listed for "at," 34 meanings for "in," and 39 meanings for "on" (See Appendix B).

3.2. Subjects

Subjects are 64 Japanese university students, 114 Japanese high school students, and 36 Filipino university students.   All of the Japanese subjects' L1 is Japanese, while all of the Filipino subjects' is Tagalog, the base language of Filipino which is the official language of them.   All of the Japanese subjects have learnt English since they entered junior high school, while, the Filipino subjects started learning English when they entered kindergarten or elementary school, and some of them started when they were two or three years old.

3.3. Procedure

Subjects in all groups were given instruction to write down intuitively as many sentences as possible by using the target prepositions within the limited time (one minute for each preposition). .

Two methods were used for analysing the sentences produced by the subjects. One was analysis of all the sentences produced by the subjects in order to find out which meanings were more frequently produced. The other was analysis of the first and the second sentences. This was because some of the subjects produced only one or two sentences during the limited time.

For the purpose of finding out the prototypical meanings for the subjects, two methods of analysis were used: The first one was to identify which meanings were more often produced by subjects (frequency effect), and the second one was to examine which meanings first occurred to the subjects (prototype effect). As Rice et al. (1995), Rice (1996), Tanaka (1983, 1987), and Ueda (1996, 1997) pointed out, if a certain meaning is a prototype in a polysemous word, it would rank in a high position of the list of the sentences produced by the subjects and also would be highly produced.

3.4. Results

The sentences produced by the subjects were analysed according to the differences in their meanings. The analysis was based on the criteria below:

1) The sentences that did not make any sense were omitted.

2) Even if the sentences had some trivial grammatical or spelling mistakes, they were to be counted for analysis, if their meanings can be understood.

3) Only the sentences in which the target words were used as pure prepositions were counted for analysis. That is, the sentences in which the target words were used as adverbs (part of verb phrases or adverbial phrases) were not counted for analysis.

4) The sentences in which the prepositions were used as a *chunk* were also left out of the analysis. When we judge whether it was a chunk or not, we used the results of concordance of the analysis of several junior high school English textbooks for students at all of the grades. The phrases that appeared frequently in the textbooks were judged as chunks. The chunk phrases will be shown in the list of the results below.

Table 4, 5 and 6 show the results of Experiment. Top 3 meanings are listed in each group.

Table 4. Production Frequency List of the Produced Sentences Using *"at"* (Top 3)

	WU(n=64)	HS(n=114)	DLSU(n=36)
all	1) SP1(23.08%)	1) SP1(39.74%)	1) SP1(63.39%)
	2) TM1(16.92%)	2) TM1(17.03%)	2) TM1(16.96%)
	3) TM2(6.15%)	3) SP3(3.06%)	3) SP3(5.36%)
1st	1) SP1(21.88%)	1) SP1(37.89%)	1) SP1(63.89%)
	2) TM1(20.31%)	2) TM1(18.95%)	2) TM1(22.22%)
	3) SP5(3.13%)	3) SP2(2.11%)	3) SP3(11.11%)

Table 5. Production Frequency List of the Produced Sentences Using *"in"* (Top 3)

	WU(n=64)	HS(n=114)	DLSU(n=36)
all	1) SP1(27.46%)	1) SP1(44.98%)	1) SP1(48.23%)
	2) TM1(10.36%)	2) SP2(9.29%)	2) SP7(12.06%)
	3) SP2(8.29%)	3) TM1(6.32%)	3) SP2(4.97%)
1st	1) SP1(29.69%)	1) SP1(44.86%)	1) SP1(57.14%)
	2) SP2(12.5%)	2) SP2(11.21%)	2) SP7(11.43%)
	3) TM1(10.94%)	3) TM1(5.61%)	3) AB6(5.71%)

Table 6. Production Frequency List of the Produced Sentences Using *"on"* (Top 3)

	WU(n=64)	HS(n=114)	DLSU(n=36)
all	1) SP1(24.49%)	1) SP1(46.12%)	1)SP1(37.68%)
	2) TM1(12.04%)	2) TM1(11.43%)	2) SP3(15.22%)
	3) SP3(5.11%)	3) AB3(3.61%)	3) TM1(13.04%)
1st	1) SP1(28.13%)	1) SP1(49.06%)	1) SP1(33.33%)
	2) TM1(15.63%)	2) TM1(8.49%)	2) SP3(13.89%)
	3) SP3(6.25%)	3) AB3(5.66%)	3) TM1(13.89%)

Note. Each abbreviation corresponds the one in the Appendix B.

4. Comparison and Discussion

4. 1. Discussion about the Prototypes in Subjects' Mind

From the results of the experiment among three groups, we found that the prototypical meaning of our target prepositions, in the mind of the subjects in all groups, is the most basic meaning of spatial usages.

On the other hand, there are some differences between three groups in terms of the ranking of temporal usages. Basically, the numbers of the produced sentences using the target prepositions as temporal usages were not as high as the ones using them as spatial usages. Especially, very few sentences using "in" for temporal usages were produced by Filipino university students. On the other hand, in the case of "at" by Japanese university students, there were not so many differences in the frequency of the produced sentences between the basic spatial usage ("SP1") and the basic temporal one ("TM1"). Therefore, it seems difficult to equate the temporal usages as being the prototypical meanings of the target prepositions in the mind of the subjects of this study.

Now, let us consider the effect of subjects' L1 for the construction of the prototypes of the meanings of our target prepositions. As for the construction of Japanese subjects, since the prototypical meanings of the target prepositions are the same meanings of their counterparts by one-to-one correspondences in Japanese, we are able to say that learners' L1 constraint, in this case, trying to search for the counterparts by one-to-one correspondences in their L1, has a positive effect. In the case of "at" by Japanese university students, that is, there were not so many differences in the numbers of the produced sentences between the basic spatial usage ("SP1") and the basic temporal one ("TM1"), the reason for the result was also the effect of one-to-one correspondence. The Japanese counterpart of "at," as we have seen in section 2.4, does not have any particular spatial

nouns, but only has the particle *-ni/de*.　That is, it is not clear for the subjects whether this counterpart is for the spatial usage or the temporal usage.　That seems to have caused the subjects to produce as many temporal sentences as spatial sentences.　On the other hand, as for the case of Filipino learners of English, Learners' L1 also has influenced on constructing the prototypes of the meanings.　Their counterpart to English prepositions is originally the locative marker, *sa*, and because of its positive effect, the prototypical meanings in the minds of Filipino learners were also the spatial one.

Next, we considered the correlation between the results of the groups of subjects in order to examine whether the prototype meanings in the mind of the three groups are the same or not. Tables 7 and 8 show the results of Spearman's rank order correlation coefficient.

Table 7. Spearman's Rank Order Correlation Coefficient (All Sentences Produced)

	WU-HS	WU-DLSU	HS-DLSU
at	.886**	.505*n.s.*	.675*
in	.780**	.569*n.s.*	.169*n.s.*
on	.511*n.s.*	.829**	.393*n.s.*

Table 8. Spearman's Rank Order Correlation Coefficient (Firstly Produced Sentences)

	WU-HS	WU-DLSU	HS-DLSU
at	1.000**	1.000**	1.000**
in	.896**	.031*n.s.*	.000*n.s.*
on	.857*	.904**	.694*n.s.*

(** p<.01　　* p<.05)

Judging from these results, we are able to say that in the case of "at" and "on," the prototypes of the meanings are almost the same between the groups, although there seems to be a little difference between the groups from the viewpoint of frequency effect.　In the case of "in," however, as we have seen above, there are some differences since Filipino learners of English did not produce as many temporal usages as other groups.

4. 2. Extension of the Meanings and Lexical Knowledge in Subjects' Mind

Based on these analyses, then, we will compare the results of the experiment with Dirven's radical networks of extensions of the meaning of the target prepositions, which have been shown in section 2.3, in order to examine the lexical knowledge towards the meanings of the target prepositions in each subject's mind.　First, let us compare the prototypical meanings.　As we have analysed, "SP1" in each preposition was judged as a prototypical meaning in the minds of each subject group.　That is, "used to say where something/somebody is or where something happens" for "at," "used to say where someone or something is" for "in," and "touching or being supported by a particular surface" for "on."　These correspond to the centre of the radical network of the meanings of the target prepositions.　Therefore, we are able to say that, against the results and

propositions of Ikeno (1996) or Rice (1996), the prototypical meaning of the target prepositions is the spatial one, and the extension of the meaning is from space via time into more abstract domains in this study.

Next, let us compare the production frequency list of subjects (i.e., the meanings of all of the sentences subjects produced) with the radical networks of the meanings.   Figures 3, 4, and 5 show the radical network of the meanings of "at" in the mind of each subject group.

e) manner (point on scale)**<None>**

d) area   a) point as place   b) point in time
<None>   **<SP1, SP3>**   **<TM1, TM2, TM4>**

c) state   f) circumstance
<SP2, AB2>   **<None>**

g) cause**<AB7>**
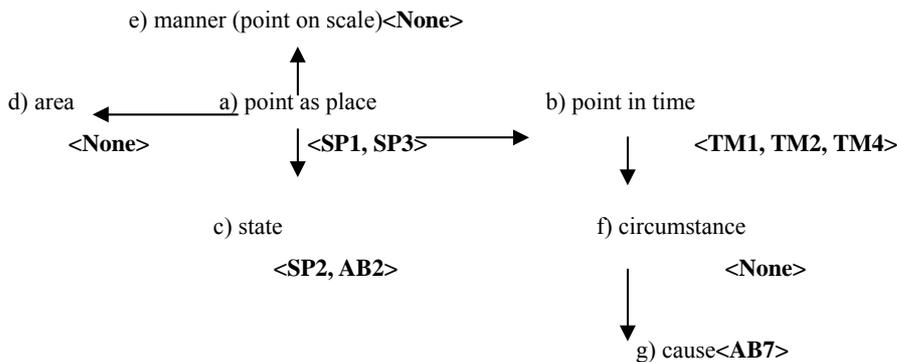
Figure 3. Radical network of the meaning of "at" in the mind of Ss at HS

Note. In the following figures from here, the bold letters put after each meaning, such as **<SP1>**, are the meanings subjects produced, which corresponds to each derivation of the meanings. The letter **<None>** means that subjects did not produce any sentences of that meaning.

e) manner (point on scale)**<None>**

d) area   a) point as place   b) point in time
<None>   **<SP1, SP3>**   **<TM1, TM2, TM4>**

c) state   f) circumstance
<SP2, AB2>   **<None>**

g) cause**<AB7>**
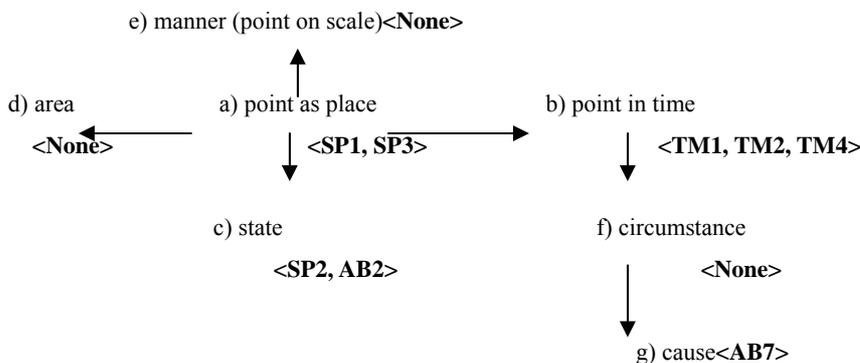
Figure 4. Radical network of the meaning of "at" in the mind of Ss at WS

As for the results of "at," two Japanese groups showed the same results.   Their production starts from the meaning a) (point as place), in the radical network of "at" (SP1 and SP3 in the results of Experiment 1), via the meaning b) (time-point) (TM1, TM2, and TM4), then expands to the meaning c) (state) (SP2, AB2) and g) (cause) (AB7).   Although Filipino subjects showed almost the same results as Japanese subjects, they did not produce any sentences with the meaning g) cause.

Without this exception, we are able to say that the lexical knowledge of the meaning of "at" among the three groups are almost identical.

e) manner (point on scale)**<None>**

d) area   ←   a) point as place   →   b) point in time

  <None>   **<SP1, SP3>**   **<TM1, TM2, TM4>**

                    c) state

   **<SP2, AB1, AB2>**   f) circumstance

                                  <None>

                           g) cause**<None>**
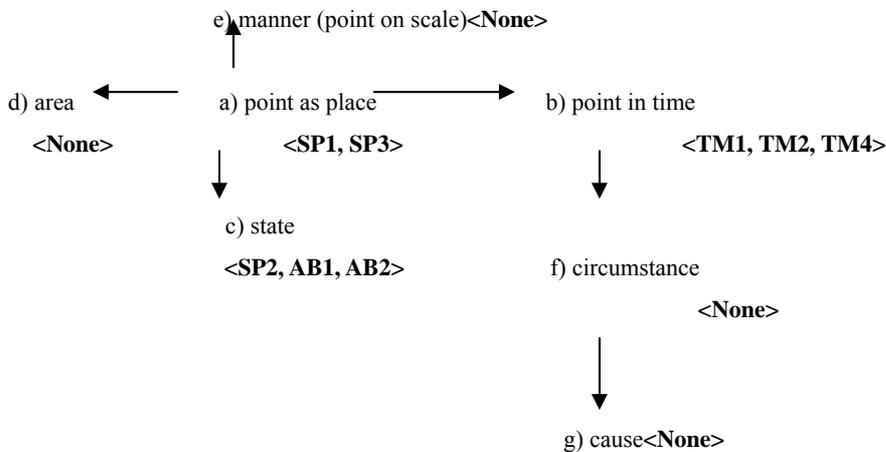
Figure 5. Radical network of the meaning of "at" in the mind of Ss at DLSU

Next, let us examine the results of "in." Although subjects of all three groups have the same lexical knowledge, as for the meanings from a) to e) (means), there are some differences at the meaning from e) (manner as state) to g) (causes as state). Figures 6 and 7 show the radical network of the meanings of "in" in the mind of Japanese groups.

e) means**<AB10>**

d) area ←——— a) spatial enclosure ———→ b) time-span

  <AB13>   **<SP1, SP2, SP5, SP7>**   **<TM1, TM2, TM3>**

                  c) state as enclosure

                   <AB6, AB22>

                  e) manner as state

                   <None>

                  f) circumstance as state

                   <AB11>

                  g) causes as state

                   <AB7>
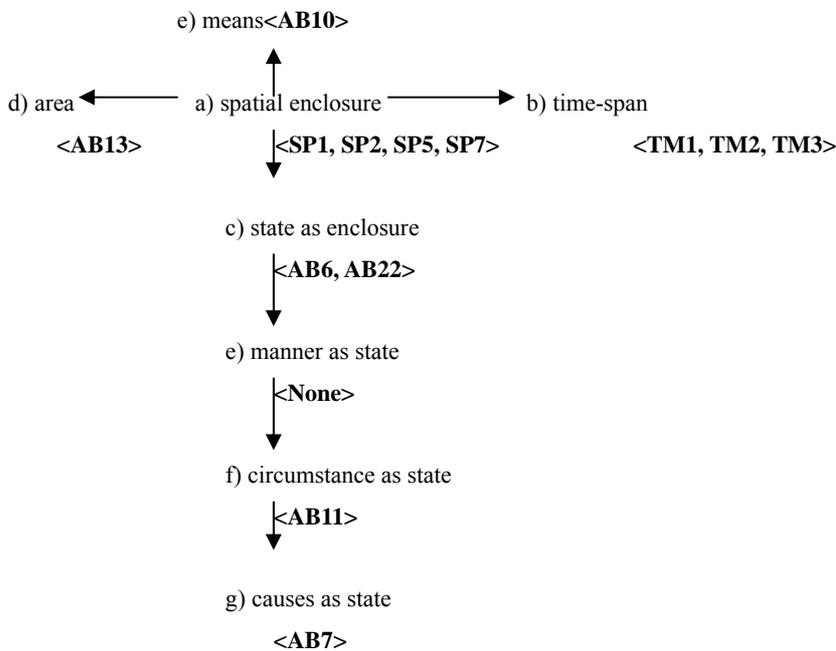
Figure 6. Radical network of the meaning of "in" in the mind of Ss at HS

e) means**<AB10>**

↑

d) area ← a) spatial enclosure → b) time-span

<SP6,AB3,AB13> **<SP1, SP2, SP7>** **<TM1, TM2>**

↓

c) state as enclosure

<AB2, AB6>

↓

e) manner as state

<AB16>

↓

f) circumstance as state

**<AB5, AB11>**

↓

g) causes as state

<None>
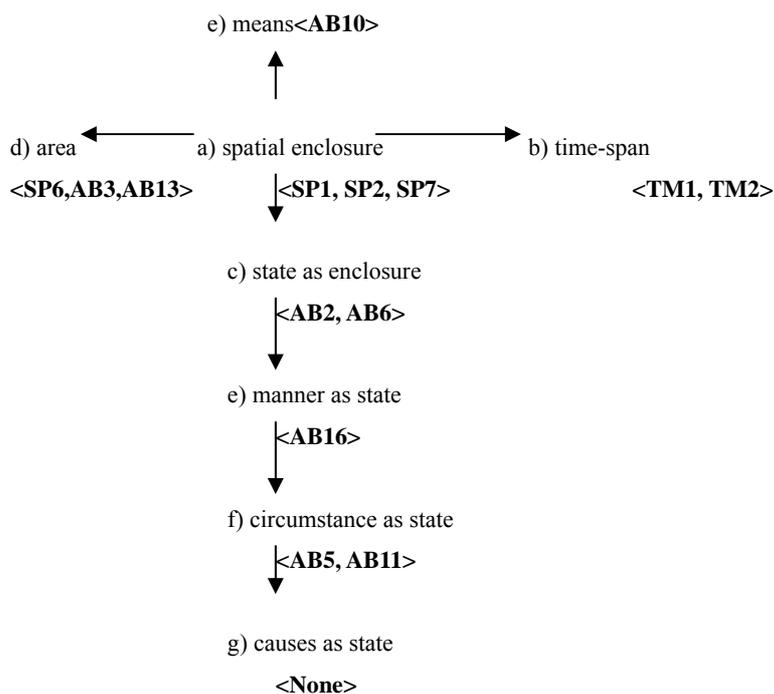
Figure 7. Radical network of the meaning of "in" in the mind of Ss at WU

There are some differences of the lexical knowledge between two Japanese groups at the peripheral meanings; that is, e) (manner), f), and g) above.   As we know, the more peripheral meaning it is, the more difficult for low level learners to learn.   That is why WU students could produce more sentences than HS students at the meaning level e)(manner) and f).   As for the meaning of g), which is the meaning that HS student could produce but WU students could not, perhaps it is because of the input effect for HS students.   That is, HS students might have had this usage in their mind clearer than WU students.   However, since this is only one exception, we are not able to say anymore about it.   Figure 8 shows the results of the case of Filipino subjects.

e) means**<AB10>**

↑

d) area ◄──────── a) spatial enclosure ──────► b) time-span

<SP6, AB3> ↓**<SP1, SP2, SP7>** **<TM1, TM2>**

c) state as enclosure

↓**<AB1, AB6>**

e) manner as state

↓**<None>**

f) circumstance as state

↓**<None>**

g) causes as state

<None>
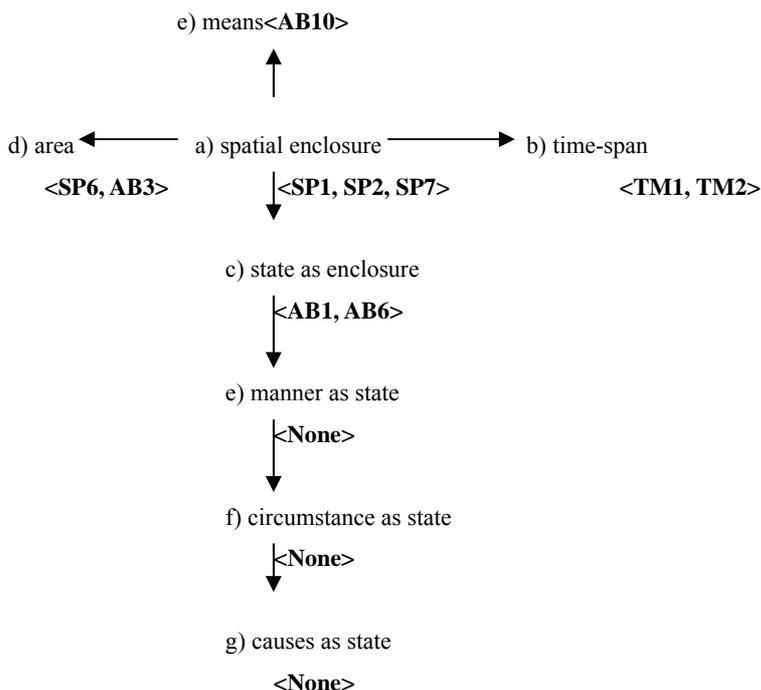
Figure 8. Radical network of the meaning of "in" in the mind of Ss at DLSU

As we have seen in the previous sections, the range of lexical knowledge of Filipino subjects to the meanings of "in" is narrower than Japanese subjects. That is, they produced very a few sentences of temporal usage. Not only to the temporal usages but also to the abstract usages, Filipino subjects do not demonstrate so much lexical knowledge as Japanese groups do. The results of this comparison also reflect this tendency.

Lastly, let us examine the results of "on." Figures 9, 10, and 11 show the radical network of the meanings of "on" in the mind of three subject groups.

e) means**<AB3, AB7>**

↑

d) area ◄──────── a) contact with line/surface ──────► b) time-expanse

<None> **<SP1, SP2, SP3>** **<TM1>**

↓ ↓

c) state f) circumstance

<AB8> **<SP5, TM2, TM3>**

g) reason**<None>**
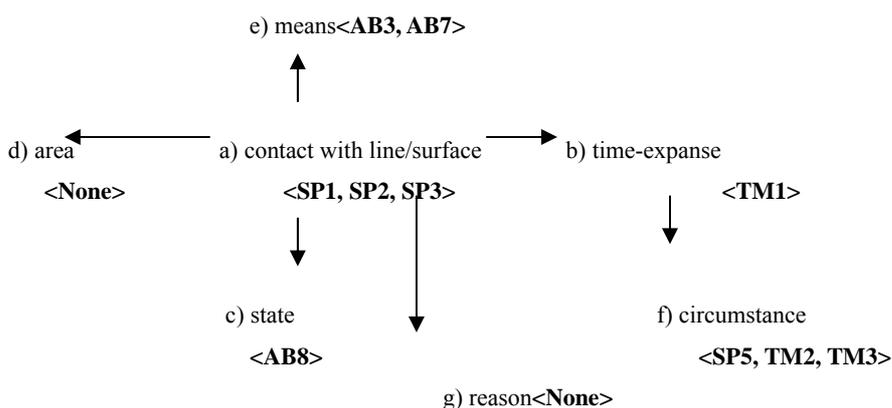
Figure 9. Radical network of the meaning of "on" in the mind of Ss at HS

e) means **<SP10, AB3, AB7>**

↑

d) area ← a) contact with line/surface → b) time-expanse

<AB22> **<SP1,SP2,SP3,SP6,SP7,SP9>** **<TM1>**

↓ ↓ ↓

c) state f) circumstance

<AB2, AB8, AB9> **<SP5, TM2, TM3>**

g) reason

<AB19>
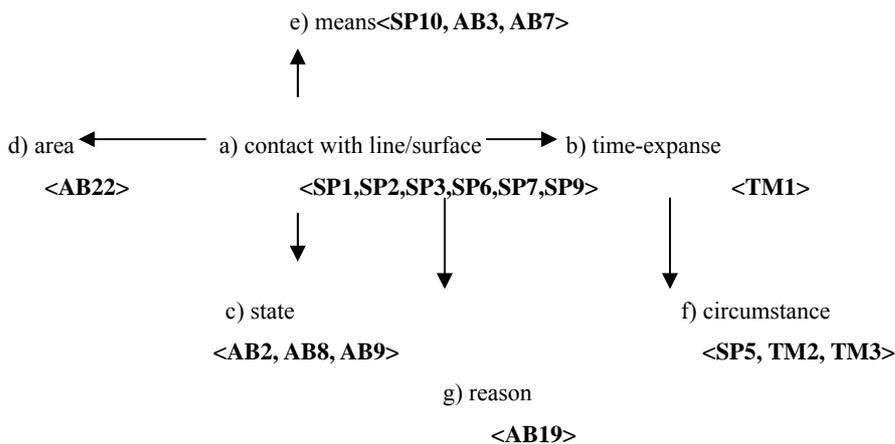
Figure 10. Radical network of the meaning of "on" in the mind of Ss at WS

e) means **<SP10, AB3, AB7>**

↑

d) area ← a) contact with line/surface → b) time-expanse

<AB4> **<SP1, SP3>** **<TM1>**

↓ ↓

c) state f) circumstance

<AB8, AB9> **<SP5, TM2>**

g) reason

<AB19>
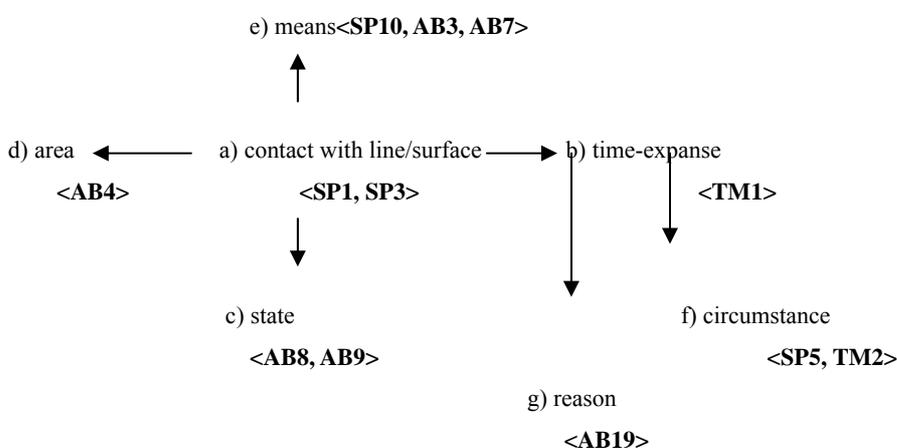
Figure 11. Radical network of the meaning of "on" in the mind of Ss at DLSU

Considering the result of each group, we can find that the range of their lexical knowledge in the minds of HS subjects is narrower than each one of other two groups. This is also due to the level of proficiency in English. WU subjects and DLSU subjects have almost similar range of the knowledge, however, DLSU students produced fewer meanings of the spatial usages in meaning a). From this result, we are able to assume that the range of the lexical knowledge of Filipino learners for the spatial usages of "on" is narrower than that of Japanese subjects.

So far, we examined the extensions of the meaning of the target prepositions and the lexical knowledge towards them in each subject's mind. We are able to conclude that the extension of the meanings follow Dirven's radical network in our learners' mind: that is, their lexical knowledge expand from spatial meaning, via temporal into the domains that are more abstract. As for the range of lexical knowledge, our assumptions are justified.

5. Conclusion

In this experiment, we examined 1) what the prototypical meanings of the target prepositions is/are in subjects' mind, 2) whether the temporal usages are also prototypes of the meanings of the target prepositions, 3) whether the prototypes in the mental lexicon are the same among the three

groups, and 4) how learners' L1 affects the construction of the prototypes. Through the experiment, we have found that 1) the prototypical meanings are spatial usages among all three groups; 2) learners' L1 has a positive effect on the construction of the prototypes in the mind of both Japanese learners and Filipino learners. Moreover, we also examined some aspects of lexical expansion in the target prepositions. Our data appear to confirm Dirven's radical network.

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Appendix A: List of Abbreviations

1P:	The first person plural form		
2P:	The second person plural form	TM:	Temporal usages (e.g., TM1)
3P:	The third person plural form		
1S:	The first person singular form		
2S:	The second person singular form	Vi:	Intransitive verbs
3S:	The third person singular form	Vt:	Transitive verbs
AB:	Abstract usages (e.g., AB1)	WU:	Waseda (Japanese university) students
adv:	A word used as an adverb		
AFX:	Affix		
CH:	Phrases subjects learnt as a chunk		
DLSU:	De La Salle (Filipino university) students		
DO:	Direct object		
DP:	Demonstrative pronouns		
DV:	Dynamic verbs		
Fr:	Fronting marker		
ft:	Future tense		
HS:	Japanese high school students		
IFX:	Infix		
IO:	Indirect object		
IPF:	Imperfective aspect		
Ir:	Irrealis		
LOC:	Locative marker		
N:	Common nouns		
Obj:	Objective		
Obl:	Oblique		
P:	Person's names		
PFV:	Perfective aspect		
PFX:	Prefix		
PH:	Phrases		
Pl:	Plural forms		
PP:	Personal pronouns		
pr:	present tense		
pt:	past tense		
R:	Root		
Sb:	Subjective		
Sg:	Singular forms		
SP:	Spatial usages (e.g., SP1)		
SV:	Stative verbs		
Ss:	Subjects		
TM:	Temporal marker		

Appendix B Definition of the Meanings of the Target Prepositions
Definition of the Meanings of "at"

	Type	Meaning	Example from the dictionaries
1	SP1	Used to say where something/somebody is or where something happens:	We'll meet at my house.
2	SP2	At a party/club/funeral etc at a public event while it is taking place:	He made his remarks at a press conference.
3	SP3	Used to say where somebody regularly works or studies:	He's been at the bank longer than anyone else.
4	SP4	If something is at a distance from something else, or at an angle to something else, it is in that place or position in relation to it:	Place it at right angles to the door.
5	SP5	In the direction of or towards somebody/something:	What are you looking at?
6	SP6	Used to state the distance away from something:	Can you read a car number plate at fifty metres?
7	TM1	Used to say an exact time when something happens:	The film starts at 8 o'clock.
8	TM2	Used to show a particular period of time during which something happens:	My husband often works at night.
9	TM3	Used to state the particular age at which somebody does something:	He left school at the age of 16.
10	TM4	You say that something happens at a particular rate to say how quickly or regularly it is happening:	Planes were taking off at ninety-second intervals.
11	AB1	Used to show a continuous state or activity:	Many children are still at risk from neglect or abuse.
12	AB2	Used to show the situation somebody/something is in, what somebody is doing or what is happening:	The country is now at war.
13	AB3	Used to show the subject or activity that you are considering when making a judgment about someone's ability:	Rosa is a genius at chemistry.
14	AB4	Used to say you are eating your breakfast, lunch, etc:	I'm sorry, Pam is at lunch just now.
15	AB5	Used to show a particular price, rate, level, age, speed etc:	The house was sold at a price of £ 250,000.
16	AB6	At somebody's invitation/command because someone asks or orders you to do something:	Rachel attended the dinner at the chairman's command.
17	AB7	Used to show the thing that caused an action or feeling:	The children all laughed at his jokes.

Note. The abbreviations used in the following tables from here such as "SP", "CH", and "PH" are explained in the List of abbreviations.

Definition of the Meanings of "in"

	Type	Meaning	Example from the dictionaries
1	SP1	Used to say where someone or something is:	My mother was in the kitchen.
2	SP2	If something is in or happens in a town, city, etc, that is where it is or where it happens:	Mr. Fisher is in Boston this week.
3	SP3	Something that is in a window is just behind the window so that you can see it through the window from outside:	There was a really nice dress in the shop window.
4	SP4	If you can see something in a mirror, lake, etc, it is a reflection from that surface:	He couldn't bear looking at his own face in the mirror.
5	SP5	If something is in a liquid, it is under it or covered with it:	I love apricots in white wine.
6	SP6	If something is in a book, speech, picture, film, play, etc, it can be found there:	In chapter 7, I discuss the relationship between sport and politics.

7	SP7	Into something:	He dipped his brush in the paint.
8	SP8	You use in when you are saying where pain, injury, or damage is:	I could not sleep because of the pain in my feet.
9	TM1	If something happens in a particular year, month, period, etc, it happens during that time:	It will be much warmer in spring.
10	TM2	If you do something in a particular period of time that is how long it takes you to do it:	He learnt to drive in six months.
11	TM3	While doing something; while something is happening:	Don't forget to tell him the news even in the upset.
12	TM4	You use in to indicate roughly how old someone is:	They are in their fifties.
13	AB1	Wearing something:	She was dressed in a blue linen suit.
14	AB2	If you are in a play, race, etc, you are one of the actors, runners, etc who take part:	He is in a play at the Theatre Royal next month.
15	AB3	If something is in a group, queue, collection, etc, it is one of the group, queue, collection, etc:	This is one of the finest beetles in the collection.
16	AB4	You use in to specify the aspect of a situation or subject that you are talking about:	Computers have recently shrunk in size.
17	AB5	Used with numbers or amounts to show a proportion:	One in every 10 children now suffers from that disease.
18	AB6	Used to show a present state or condition:	We are in a position to advise our Indian friends.
19	AB7	If you do something in surprise, in admiration, etc, you do it because of the way you are feeling or the attitude you have:	Clarissa cried out in pain.
20	AB8	If a particular characteristic or quality is in you, you have it:	She hated the bully in him.
21	AB9	Used to introduce the name of a person who has a particular quality:	We're losing a first-rate editor in Kathy.
22	AB10	Used to show the language, material, etc. used:	She spoke in a calm, friendly voice. / Her parents always talk to her in English.
23	AB11	You use in to indicate that something happens or is true when there is a particular situation or set of circumstances:	Women hold a very strong position in aboriginal society.
24	AB12	You use in to indicate that a particular feeling is directed towards someone or something:	No one took any interest in the exhibition.
25	AB13	Used to show somebody's job or profession:	She is in computers.
26	AB14	Used to show the feelings you have when you do something:	She looked at me in horror.
27	AB15	You use in to indicate an approximate amount or number:	New firms take on workers in dozens rather than in hundreds.
28	AB16	Arranged so as to form a particular shape or group:	The students sit in a circle on the floor.
29	AB17	Used to say how one person should consider another:	You've got a very good friend in Pat.
30	AB18	You use in to specify the form of something such as an amount of money, for example the units it is made of:	He walked off with £ 300 million in cash.
31	AB19	If something is in a particular colour, it has that colour:	We put up curtains in yellow and orange.
32	AB20	You use in to say that you are having a particular kind of medical treatment:	Claude will be in bandages for at least three more weeks.
33	AB21	When a plant or tree is in flower, blossom, leaf, etc, it has flowers blossom, leaves, etc, on it:	The hedgerows were all in blossom.

34	AB22	You use in when you are saying that you divide something so that it becomes two or more separate parts:	He cut the cake in two.

Definition of the Meanings of "on"

	Type	Meaning	Example from the dictionaries
1	SP1	Touching or being supported by a particular surface:	Two cushions lay on the floor.
2	SP2	Hanging from, supported by or connected to a particular thing:	Hang your coat on that hook.
3	SP3	You use on to specify a surface or place which something moves towards and where it lands, falls or stops:	He dropped it on the floor.
4	SP4	You use on to say that you are touching a part of someone's body:	She kissed him on his mouth.
5	SP5	Used to show direction:	My father sat on my right.
6	SP6	In a particular place, building or area of land:	My father worked on a farm.
7	SP7	On one of the sides of something such as a river or road:	We had a break at a cafe on the river.
8	SP8	You use on to say that something is included as a part of a list, timetable, etc:	The item was not on the agenda.
9	SP9	You use on to say that you are travelling along a road or river:	We were driving on a California freeway.
10	SP10	You use on to specify the material or object on which something is written, painted, or printed:	On the map it seems much smaller.
11	TM1	You use on to specify a day, date, or occasion:	Carol was born on April 10th.
12	TM2	During something:	I met several people on the voyage.
13	TM3	Immediately after something has happened or after someone has done something:	On arriving home I discovered they had gone.
14	AB1	You use on to say that someone's face shows a particular expression, such as a smile:	She had a puzzled expression on her face.
15	AB2	Being carried by somebody; in the possession of somebody:	I didn't have any money on me.
16	AB3	You use on to show a means of transport:	He was on the plane from New York.
17	AB4	About a particular subject:	She was asking him on the matters of education.
18	AB5	You use on to specify the particular method, system, or set of principles that is being used:	Burglar alarms operate on a variety of principles.
19	AB6	You use on to say what tools or instrument you are using in a particular activity:	It's amazing what you can do on these new word processors.
20	AB7	By means of something; using something:	President Bush will appear on television later this week.
21	AB8	Used to describe an activity or a state:	I was on holiday in Italy.
22	AB9	Used to show that somebody belongs to a group or an organization:	She has been on a member of committees.
23	AB10	Eating or drinking something; using a drug or a medicine regularly:	He lived on junk food.
24	AB11	You use on to say what items are involved in taxes, fines, profits, etc:	They have to pay fines on their books.
25	AB12	Supported financially by something:	The drinks are on me.
26	AB13	You use on to say or what purpose you are spending or giving your money, time, or effort:	I've wasted too much money on her.
27	AB14	Used with some nouns or adjectives to say who or what is affected by something:	The parents' divorce has had a particularly bad effect on the children.

28	AB15	You use on to refer to an agreement or discussion:	They agreed on three points.
29	AB16	You use on to specify the cause of injury or damage, especially to a person's body:	He cut himself on the window.
30	AB17	You use on to say what fuel or form of power is used to make something work:	Most cars run on petrol.
31	AB18	You use on to specify the financial or legal arrangement under which something is bought or sold:	I bought it on credit.
32	AB19	Used to show the basis or reason for something:	On their advice I could apply for the job.
33	AB20	You use on to specify the intensity or scale of an activity:	We're going to build on a large scale.
34	AB21	You use on to specify the kind of job that you are doing, or the kind of life that you are living:	I applied for a job on the railway.
35	AB22	You use on to say what your thoughts or energies are directed towards achieving:	She was concentrating on her personal life.
36	AB23	You use on to say what you are trying to produce:	Scientists are working on microchips which will hold a million words.
37	AB24	You use on to say whether something wastes or saves money, fuel, or material:	This car is more economical on fuel.
38	AB25	Compared with somebody/something:	The sales of this store are 10% up on last year.
39	AB26	Used when giving a telephone number:	You can get me on 0181 530 3906.