A Prototype Analysis of the Learning of *On* by Japanese Learners of English and the Potentiality of Prototype Contrastive Analysis (Part I)

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1. Introduction

The usage of English prepositions is a difficult area for Japanese learners of English. Each preposition has a variety of uses and learners are often perplexed in their attempts to acquire a definite and coherent perspective on these uses, which may seem almost chaotic to many of them. Although some uses of a given preposition may be quite easy to learn, other uses of the same preposition can turn out to be very difficult.

The preposition *on* is typical of such a case. For example, almost all Japanese learners acquire its use in an expression such as 'a book on the desk,' but they often fail to learn the use in 'a dog on a leash.' Moreover, overextension of *on* is often observed in cases where other English prepositions are required, e.g., 'a plane on the cloud.'

At first sight, the situation may seem to be simply due to the influence of *ue* in Japanese which is generally conceived of as the Japanese lexical item corresponding to *on* by Japanese learners of English. Learning the first example above may be accelerated by the fact that its Japanese equivalent expression includes *ue*, while the failure in the second example in the form of underextension of *on* can be explained by the lack of *ue* in the equivalent Japanese expression. Conversely, overextension of *on* in the third example may be accredited to the fact that its Japanese equivalent requires *ue*.

It seems insufficient, however, to explain the learning of the usage of *on*, including the first and second examples, by the simple correspondence of *on* and *ue* in English and Japanese. For example, even in several uses of *on* whose Japanese equivalents do not equally require *ue*, there seem to be different degrees of difficulty in their learning. It may be possible, therefore, to suppose that the usage of the English preposition *on* has a hierarchical organization of some kind, and the learning difficulty of its various uses is determined inherently according to this hierarchy.

For the case of overextension of *on*, as in the third example, it appears to be necessary to investigate the semantic relations between Japanese *ue* and some other English prepositions including *on*.

In order to examine the first possibility of a hierarchical organization of *on*, the author (Yamaoka, 1991) conducted an experimental study with Japanese learners of English. A hierarchical organization of various uses of *on* was worked out by adopting a prototype theory. Fundamentally, the theory states that our perceptual categories are characterized by internal structures which are composed of a ‘core meaning’ consisting of the ‘clearest cases’(best examples or prototypes) of the category, ‘surrounded’ by other category members of decreasing similarity to that core meaning (Rosch, 1973, p. 112).

A kind of semantic feature analysis was carried out covering the following uses of *on*.

1. There is a book on the desk.
2. There is a spider on the ceiling.
3. The frost made patterns on the window.
4. The coat is on the peg.
5. Look at the laundry on the line.
6. The dog is on the leash.
7. There is an inn on the lake.

The analysis revealed several semantic features which each of these uses of *on* could or could not possess. Moreover, it was found that these uses could be arranged in a hierarchical order according to how many of the features each use could possess as is shown in Table 1.
Table 1 Original Semantic Feature Analysis of Various Uses of On

<table>
<thead>
<tr>
<th>Feature</th>
<th>1'</th>
<th>2'</th>
<th>3'</th>
<th>4'</th>
<th>5'</th>
<th>6'</th>
<th>7'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Physicality</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>?</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Support</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>?</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Surface</td>
<td>++</td>
<td>++</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Horizontality</td>
<td>++</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Higherness</td>
<td>++</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

+(possession of the feature)
? (potential possession of the feature)
-(lack of the feature)

Table 1 also indicates that the various uses of on have a prototype hierarchical organization: (1') occupies the prototype and the others are arranged according to the degree of similarity to the prototype.

An interesting corollary of the prototype theory predicts that category membership of central instances (prototype) is learned before membership of peripheral instances in the hierarchy. This is what has been attested to by Bowerman (1977) in vocabulary development and de Villiers (1980) in English passive and cleft sentences in first language acquisition of English, as well as by the author (Yamaoka, 1988) in the 'be easy to V' structure and Hartford (1989) in object-coding in verbs of saying in second language learning of English. In the case of on in second language learning, it is also expected that its various uses will be learned in the hierarchical order shown in Table 1.

The previous study (Yamaoka, 1991) was conducted to confirm the order hypothesis with 102 Japanese university students learning English using 25 sentences, including the experimental sentences (1'-7') shown above. Subjects were required to write what they considered to be the best preposition in a blank in each sentence. Every sentence was accompanied by a picture which depicted the meaning of the sentence. The results in terms of accuracy of suppliance for each experimental sentence are presented in Table 2.

Table 2 Accuracy Rates (%) of Responses to Each Sentences by Japanese Subjects

<table>
<thead>
<tr>
<th>Sentence No.</th>
<th>1'</th>
<th>2'</th>
<th>3'</th>
<th>4'</th>
<th>5'</th>
<th>6'</th>
<th>7'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>100</td>
<td>82</td>
<td>72</td>
<td>63</td>
<td>30</td>
<td>12</td>
<td>1</td>
</tr>
</tbody>
</table>

A McNemar test showed statistical significance between the scores of any of the adjacent pairs except for 3'-4', generally confirming the order hypothesis. Examination of the response pattern of each subject for these experimental sentences also revealed a general tendency of an implicational hierarchy: a correct response in a lower position of the hierarchy implies a correct response in any of the higher positions.

These results indicate both the validity of the prototype organization of various uses of on proposed in Table 1 and the effectiveness of the order hypothesis of learning.

It must be pointed out here that the uses of on in (1')-(7') occupy only a part of all uses of the preposition. Other uses include, for example, 'on that night' (time), 'on fire' (state), 'on the
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average' (ground), 'write on politics' (reference), etc. It should be noted that these uses are figurative extensions of the physical and prototype use of the preposition, and thus, they fall in the most peripheral part of the hierarchical organization of this preposition. In the earlier study by the author (Yamaoka, 1991), several of these figurative uses were also included in the experiment along with the physical uses shown in (1')-(7'). The results indicated that subjects' knowledge of these figurative uses was random: those subjects with fair knowledge of the physical uses did not necessarily show good knowledge of the figurative uses, and some with poor knowledge of the former showed fair knowledge of the latter. The implicational relationship of learning did not hold in these figurative uses. This led the author to conclude that the subjects learned these figurative uses of on in a rather mechanical manner without applying semantic analysis or figuring out any coherent correspondence to the physical uses. As far as these subjects are concerned, knowledge of the figurative uses is independent of the physical uses.

Seen from a learning perspective, it might be possible for the learner to find in the figurative uses a potential semantic feature which is common to the physical uses after familiarizing him- or herself with the latter uses, but it would be almost impossible for them to come to grasp the essential semantic feature of on in the figurative uses without reference to the physical uses. This is in accord with the prediction of the prototype theory of learning: from the prototype to the peripheral. In spite of this peripheral nature of these figurative uses, however, some of them are frequent in use. It is quite plausible, therefore, that they are learned individually and mechanically without undergoing semantic analysis, resulting in violation of the learning expectation of the prototype organization. Thus, these figurative uses were not included in the present study.

2. Aims of the Study

The present study was conducted to attain two aims. The first was to verify the results of an earlier study (Yamaoka, 1991) by replicating the experiment under improved experimental conditions devised to improve its validity. The second was to explore the mechanism of native-language interference which might result in the overproduction of on.

With respect to the first aim, the earlier experimental study was found to suffer from the following weaknesses:

1) It lacked a control group of native speakers of English.
2) The Japanese subjects were limited to university students.
3) Only one experimental sentence was employed for each sentence type.
4) The prototype analysis (Table 1) may have been partially flawed.

Point (1) is critical in that since each sentence in the experiment was accompanied by a picture intended to depict the meaning of the sentence, native speakers should have been included to confirm that the pictures really did depict the intended semantic relationships. Point (2) is related to the subjects' proficiency level. High-school students, who are likely to be less proficient in English than university students, could be expected to reveal more about the learning process. Point (3) is also a serious weakness. As Clark (1973) warns, in an experimental study involving language, it must be safely warranted that stimulus items selected really represent the population in which they are included. The earlier study cannot be said to have met this condition since only one sentence was used to represent each type. It is quite rare in language that one sentence properly represents all possible sentences of a given type; at least two sentences should therefore be utilized for each sentence type. Point (4) is an experiential judgment: it is against our teaching experience, for example, that sentence (2') is easier than (3') for Japanese learners of English. In fact, in a similar experiment conducted with Japanese high-school subjects, type (3') showed a higher accuracy than type (2') did (Inatsugu, 1991). This indicates that the analysis shown in Table 1 must be refined.

As for the second aim concerning mother-tongue influence, a different kind of analysis is needed. Most importantly, the prototype use of on happens to coincide with the prototype use of ae in
Japanese, and, thus, subjects can be expected to overextend the use of *on* in English sentences whose Japanese equivalents require *ue*. In order to explore this expectancy, several sentences in this category were prepared and included in the distractor sentences in the present experiment. Responses to these sentences were examined in terms of error analysis in order to investigate the influence from Japanese.

3. Present Study

Giving due considerations to the weaknesses of the earlier experiment and the requirements of the second aim, the present study was devised and conducted as follows:

**Subjects**

Subjects consisted of the following four groups:

NS: 17 adult native speakers of English taking a course in applied linguistics at a university in Canada. Their ages ranged from 18 to 36 with a median of 23.

JA: 36 Japanese university students majoring in Russian at a university in Japan. Their ages were all around 19. They started learning the language after entering the university, and English was a second foreign language for them there. But, they had learned English for six years in junior and senior high school before entering university.

JB: 34 Japanese university students majoring in elementary school education at a university in Japan. They were all aged around 20. English was the only foreign language for most of them. They also had learned English for six years in junior and senior high school before entering university.

JC: 38 Japanese senior high school students taking a commercial course at a high school in Japan. They were all aged around 16. English was the only foreign language for them.

Note that each of these three Japanese groups was expected to represent a different proficiency level of English. Although no subjective measurement was made, this seems to be a reasonable speculation: while a higher level of proficiency was presupposed for subjects in the JA group since they were required to pass university entrance examination in which English occupied a central part, such a level was not assumed for subjects in the JB group since English was not a major part of their university entrance examination. Subject in the JC group could be expected to have the lowest level of English proficiency since they had learned English for only three years at the time they took part in the experiment.

**Test Material**

Seven types of target sentences with two sentences for each type were prepared (the figure in parentheses at the end of each sentence corresponds to the sentence number in the test material shown in Appendix 2, which will appear in part 2 of this article):

1a. There is a book (on) the desk. (8)
   b. Flora sits (on) the sofa. (32)

2a. Look at the picture (on) the wall. (11)
   b. The frost made patterns (on) the glass surface. (46)

3a. He put his hat (on) the peg. (30)
   b. The coat is (on) the hook. (54)

4a. There are several bats (on) the roof of the cave. (20)
   b. Thoro is a spider (on) the ceiling. (40)

5a. There are three apples (on) the branch. (4)
   b. Look at the laundry (on) the line. (22)

6a. The dog is (on) the leash. (27)
   b. A bunch of balloons is (on) a string. (36)

7a. There was a small town (on) the Mississippi River. (16)
   b. They found an inn (on) the lake. (45)

Forty distractor sentences were also prepared. In order to explore the possibility of native-language influence, the following eight sentences were included among the distractors. Note that Japanese equivalents of all these eight sentences require *ue* and thus they invite overextension of *on* in their responses from Japanese subjects.

8 Raise your hands ( ) your head. (5)
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Hypotheses

Two hypotheses were formulated for the two aims of the study. Before presenting each hypothesis, it will be helpful to follow the theoretical considerations lying behind them.

For the first aim, a reanalysis was made of the earlier prototype organization on the seven types of the use of on, which yielded the modified hierarchical organization presented in Table 3.

Table 3

<table>
<thead>
<tr>
<th>Feature</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Physicality</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Support</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Surface</td>
<td>+</td>
<td>?</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Surface-Contact</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Higherness</td>
<td>+</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Horizontality</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

Table 3 Revised Semantic Feature Analysis of Various Uses of On

Here a new feature, 'Surface-contact' is added to the list of features made in the earlier experiment (Table 1), by which it is meant that the item that is supported by another has a surface which is in contact with the surface of the supporting item.

According to Table 3, the first hypothesis can thus be formulated as follows:

(1) The accuracy of the responses by Japanese subjects for each target sentence type will increase along the hierarchical arrangement, with the prototype showing the highest accuracy. This will be reflected both in a general response pattern of all the subjects and in the implicational response pattern of each individual subject.

The second hypothesis is constructed on a prototype contrastive analysis of ue and on as well as some other English prepositions. While the core
meaning of *on* is 'contact,' in the case of *ue* it is 'higherness.' Importantly, 'higherness' of *ue* in Japanese simply indicates a higher positional relationship one item keeps to the other irrespective of any other semantic relations which can co-occur with this feature; e.g., contact, coverage, disconnected higherness, etc. In contrast, these semantic relations are encoded by different prepositions in English. Table 4 shows these prepositions with their core meanings and prototypes of use.

To reiterate the important point here - each prototype of these prepositions involves a common feature of 'higherness.' Thus, Japanese equivalents of these prototypes all require *ue*. In other words, Japanese *ue* covers a semantic field which is divided among different prepositions in English. It is a mistake, however, to assume that every use of each of these English prepositions can be expressed with *ue* as its Japanese equivalent. There are cases where *ue* cannot apply. For example, the following expressions cannot be rendered with *ue* in their Japanese equivalents.

16 a dog on the leash
17 travel all over Europe
18 above suspicion
19 walk up the slope

Interestingly, these expressions exhibit uses which are peripheral in their respective prototype organizations. Thus, we can say that *ue* covers only a prototypical part of the semantic field that each of these four prepositions respectively covers. The semantic relations between *ue* and these four English prepositions can be represented as in Fig. 1.

This leads to the following predictions concerning the learning processes of these prepositions by Japanese learners:

(a) Learners have to recognize that English has different prepositions that divide semantic field covered by Japanese *ue*, and they have to possess these prepositions as different lexical items for
describing different relations.

(b) They have to correctly divide the semantic field of *ue* mainly according to the core meaning of each of these prepositions.

(c) They have to recognize that *ue* covers only a prototypical part of the semantic field that each of these prepositions covers.

From the discussion above, the second hypothesis can now be formulated as follows:

(2) In their response patterns to the intended distractor sentences, Japanese subjects will show evidence of overextension errors of *on* where other English prepositions are required, which can be said to arise from interference of *ue* in Japanese.

Note

This article is based on an oral report read at the 18th Convention of the Federation of English Language Education Societies in Japan, held at Fukuoka, Japan on August 7, 1992. The study was partly supported by a fund provided by the Academic and Cultural Foundation of the Sanyo Broadcasting Company. A partial and preliminary report of the study was made in Report No. 36 published by the Foundation (Yamaoka, 1992). I would like to express my deepest gratitude to Professor Hector Hammerly of Simon Fraser University who kindly conducted the part of the experiment with native speakers of English, and to Professor Albert John Chick of Hyogo University of Education who helped me refine the earlier version of this article.

References


(10) There is a church ( ) the farm.
(11) She is standing ( ) the center of the circle.
(12) The dog is ( ) the leash.

(13) She sat ( ) the fire.
(14) There is a path ( ) the wood.
(15) There is a spider ( ) the ceiling.

(16) There is a little water ( ) the vase.
(17) The cat is ( ) the table.
(18) There is an inn ( ) the lake.
日本人英語学習者による'on'の習得のプロトタイプ的分析と
プロトタイプ的対照分析の可能性（1）

山 岡 俊比古

前言

英語前置詞'on'の日本人英語学習者による習得を、この前言のさまざまな用法のプロトタイプ論的分析に
よって得られる階層構造によって説明できることを実験
的に明らかにし、プロトタイプ的対照分析手法の有効性
を提示する。第1部としての本論では、このうちの実験
に至る理論的整備と、実験の実施までを扱う。実験結果
とその分析および結論、さらにこの結論に基づいたプロ
トタイプ的対照分析手法への示唆については、第2部で
扱う。なお、本論は著者（1992）における予備的考察を
補完するものである。