Effects of Noticing a Hole on the Incorporation of Linguistic Forms: Cognitive Activities Triggered by Noticing a Hole and Their Effects on Learning

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Abstract

This study aims to clarify (a) how noticing a hole during output encourages learners of English to incorporate linguistic forms into their IL system and (b) what cognitive activities are triggered by noticing a hole. A total of 102 undergraduate students, who were divided into 3 groups based on their English proficiency, took part in an experiment, in which they worked on guided summarizing, wrote down what they had thought when noticing a hole and were exposed to relevant input. The participants were asked to work on the same guided summarizing in the following week without previous notice to examine how they incorporated linguistic forms into their IL system from the relevant input. The results are: (a) noticing a hole during output encourages learners of English to incorporate linguistic forms into their IL system from the relevant input, (b) noticing a hole triggers various cognitive activities and they have different influences on the incorporation of linguistic forms and (c) learners with high proficiency incorporate more linguistic forms into their IL system from the relevant input.

1. Introduction

1.1 Background

Quite a few Japanese learners of English seem to face a problem of how they can move from an initial state, where target forms are not known at all, to an end-state, where they have some command over the system of the target language (TL) and use that system for production. For them to be able to use the TL for production, they need to notice their linguistic deficiency through output and bridge the gap between their interlanguage (IL) and the TL. The procedure where relevant input is presented after producing output (henceforth, the output-input activity) offers learners with an opportunity to notice their linguistic deficiency and to compare their own linguistic realization with its TL form. Noticing which they experience during the procedure is
assumed to trigger cognitive activities which contribute to second language (L2) learning.

1.2 Noticing a Hole

Although some researchers argue that L2 learning takes place without noticing (Gregg, 1984; Tomlin & Villa, 1994), there have been no studies which support the marginality of noticing in L2 learning. Although people sometimes pick up subliminal signals they already know, there is no evidence as yet that new information can be picked up in such a manner (Schmidt, 2001). It should be noted that noticing is necessary and facilitative for L2 learning.

There are three levels of noticing: noticing a hole, noticing a form and noticing the gap (Swain, 2000). “Noticing a hole” occurs when learners cannot encode their intended meaning in an L2. “Noticing a form” occurs when learners simply notice a form in input. “Noticing the gap” occurs when learners notice the difference between their own linguistic realization and the TL form suitable for their intended meaning.

While quite a few studies have dealt with how noticing a form contributes to L2 learning (Hanaoka, 2007; Leow, 1997), only a few have dealt with the effects of noticing a hole on L2 learning. The present study focuses on the effects of noticing a hole on the incorporation of linguistic forms. As Tarone and Liu (1995) have pointed out, the situation where learners are struggling to express themselves in an L2 is most likely to bring about the desirable changes in their IL system. Compared with native speakers, learners’ knowledge of the TL is limited and their access to the knowledge is less efficient. During output, they notice more holes than native speakers. Noticing a hole triggers various cognitive activities, such as searching for a lexical item to convey the intended meaning, manipulating the intended meaning and thinking about how a lexical item should be used in a sentence. It is of great interest to clarify their effects on learning.

1.3 Output

The importance of producing output was not recognized properly in the early 1980s. To quote Skehan (2002), “…output has been viewed either as the immediate and pervasive consequence of underlying structural change, or the result of a process of automatization” (p. 85). Output was considered to be the consequence of learning rather than the process of learning and was synonymous with what learners had learned. This view was questioned by Swain (1985), who proposed the potential roles of producing output in L2 learning.

While comprehension allows many linguistic signals to be ignored, producing output requires L2 learners to think about syntax and access lemmas stored in their mental lexicon. It should be stressed that producing output has a significant role to play in raising L2 learners’ consciousness towards linguistic forms, which often lose out to meaning during comprehension.

1.4 The Output-Input Activity

Traditional instruction on isolated grammatical forms is insufficient to promote their
learning (Long & Robinson, 1998), yet purely communicative approaches have been inadequate for developing high levels of TL accuracy (Swain & Lapkin, 1998). If the goal of L2 classroom activities is to develop both accuracy and fluency, meaning-focused activities should be integrated with form-focused activities, particularly those requiring output.

The output-input activity seems effective in restructuring learners’ mental representations. Immediate juxtaposition of learners’ output and relevant input is considered to offer an ideal situation for developing their IL system. During output, they notice a hole and noticing a hole is assumed to trigger various cognitive activities. If relevant input is provided in a timely manner, they voluntarily channel their attentional resources towards a relevant linguistic form to fill the hole. The output-input activity seems to offer learners with an opportunity to process linguistic forms deeply by triggering the three levels of noticing. It is also likely to lead learners to establish strong form-meaning connections. Figure 1 illustrates how the output-input activity contributes to L2 learning.

![Diagram]

Noticing a hole

Cognitive activities triggered by noticing a hole

Linguistic realizations with heightened sense of problematicity

Relevant input

Noticing a form / the gap

Processing of the noticed form for comprehension

Incorporation of the form

Figure 1 A way in which the output-input activity contributes to L2 learning

1.5 Learners’ TL Proficiency

The minimum requirement of noticing is to pay attention to linguistic forms in input with greater than a threshold level of subjective awareness (that is, reportable subsequent to the experience). Noticing is thus “subjective correlate” (Schmidt, 2001, p. 5) of attention. If noticing reflects a learner’s private experience, it can be influenced by various learner characteristics. Schmidt (1990) has claimed that noticing depends on each learner’s readiness, which is represented in his or her TL proficiency.

Cognitive effort of learners with low proficiency is spent primarily on the retrieval of lexical items during output. Learners’ TL proficiency is likely to influence both cognitive activities triggered by noticing a hole and the processing of a noticed form, and thus the incorporation of the noticed form.
1.6 Research Questions
Based on the above discussion, three research questions were formulated:

1. Does noticing a hole during output encourage learners to incorporate linguistic forms into their IL system?
2. What cognitive activities are triggered by noticing a hole? How do they contribute to the incorporation of linguistic forms?
3. Do all learners equally benefit from the output-input activity irrespective of their TL proficiency?

2. Method

2.1 Participants
A total of 102 participants took part in the experiment. The participants were undergraduate students who were not majoring in English. Their ages were from 18 to 22. They were classified into three groups based on their English proficiency: Upper group, Middle group and Lower group. The test employed to evaluate their proficiency in English was a reading comprehension test consisting of 40 questions. The participants were given scores from 0 to 100. The proficiency levels of the three groups were found to be significantly different from each other, $F(2, 99) = 178.271, p < .05$. Table 1 shows the mean scores on the proficiency test of the participants.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M (max = 100)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>34</td>
<td>61.68</td>
<td>7.83</td>
</tr>
<tr>
<td>Middle</td>
<td>35</td>
<td>76.71</td>
<td>2.58</td>
</tr>
<tr>
<td>Upper</td>
<td>33</td>
<td>84.55</td>
<td>2.91</td>
</tr>
<tr>
<td>Total</td>
<td>102</td>
<td>74.24</td>
<td>10.71</td>
</tr>
</tbody>
</table>

2.2 Guided Summarizing
The effects of producing output on IL development can be maximized if an output task provides learners with opportunities to reflect on how a lexical item should be used in a sentence. One of the promising candidates is a technique called guided summarizing. Compared with autonomous summarizing in which learners summarize a passage in their own way, it is capable of leading learners to use specific lexical items (Muranoi, 2006). By directing learners to use specific lexical items, it indirectly leads them to use specific grammatical forms.

2.3 Procedure for Collecting Data
The procedure for collecting data consists of four stages and the participants had been
informed of the procedure in advance. The procedure for collecting data is as follows:

Stage 1 The participants, following the directions (see Appendix), work on a text-reconstruction task called guided summarizing (Output 1).
Stage 2 The participants write down what they thought when noticing a hole.
Stage 3 The participants are provided with relevant input.
Stage 4 The participants work on the same text-reconstruction task as that of Stage 1 in the next week without previous notice (Output 2).

2.4 Analysis

In order for the data analysis to be reliable, three investigators, who all teach at college-level institutions, analyzed all the data independently and subsequently the results of the analysis were checked against from each other. When there were disagreements between the three investigators, the disagreed protocols were discussed to get an agreement.

2.4.1 Noticing a Hole

At Stage 2, the participants wrote down what they had thought when noticing a hole in their first language. The number of reports they provided at Stage 2 was 1,883. The three investigators judged that the participants noticed a hole in the 1,883 cases.

2.4.2 Cognitive Activities Triggered by Noticing a Hole

The first investigator analyzed the 1,883 protocols and set up eight descriptive categories. They were: lexical search, semantic manipulation, accessing lemmas, recollection of spelling, retrieval of construction, discourse arrangement, comment on pre-selected forms and others. In setting up the categories, Cumming (1990) and Takatsuka (1997) were consulted. The second and the third investigators put the 1,883 protocols into the eight categories. The agreement rate was approximately 91% and the disagreed protocols were discussed to reach an agreement. There were 139 protocols which were put into others. As the protocols of this group are heterogeneous, these 139 protocols will be excluded from the future discussions. The seven descriptive categories are listed below with examples:

1. lexical search
   (a) I should use the word *accompany* to mean “isshonihairu.”
   (b) I could not remember the word to mean “kaijoken.”

2. semantic manipulation
   (a) "Horitsuganai" means "horitsuwomotteinai."
   (b) "Inuniokonawaseru" is regarded to mean "inunitayoru."

3. accessing lemmas
(a) Can I use a verb after the expression *be accustomed to*?
(b) The word *show* can have two objects.

4. recollection of spelling
   (a) I am not sure how to spell the word “kurumaisu.”
   (b) I thought about how to spell the word *thousand*.

5. retrieval of construction
   (a) I should use a passive construction with the phrase *guide dogs* being the subject.
   (b) I can use existential *there* here.

6. discourse arrangement
   (a) I thought about the relationship between the first sentence and the second sentence.
   (b) I have to use the word *however* to connect sentences properly.

7. comment on pre-selected forms
   (a) It was difficult to use the word *accompany*.
   (b) I did not understand why I had to use the word *placing*.

2.4.3 Incorporation of Linguistic Forms

The participants’ Output 1 and Output 2 were compared. There were 1,475 cases in which the participants used different linguistic forms between Output 1 and Output 2. In 835 cases, they used the same linguistic forms from the relevant input in Output 2. It was judged that the participants incorporated linguistic forms in the 835 cases.

3. Results and Discussion

3.1 Research Question 1

Does noticing a hole during output encourage learners to incorporate linguistic forms into their IL system? Table 2 shows how noticing a hole promotes the incorporation of linguistic forms.

<table>
<thead>
<tr>
<th></th>
<th>Incorporation</th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(+)</td>
<td>(-)</td>
<td></td>
</tr>
<tr>
<td>Noticing a hole</td>
<td>784</td>
<td>534</td>
<td>1,318</td>
</tr>
<tr>
<td></td>
<td>51</td>
<td>106</td>
<td>157</td>
</tr>
<tr>
<td>Total</td>
<td>835</td>
<td>640</td>
<td>1,475</td>
</tr>
</tbody>
</table>

A test of independence was conducted and the results of statistical analysis show that noticing a hole and the incorporation of linguistic forms are not independent, $\chi^2 (1, N = 1,475) = 41.636, p$
As discussed in 1.2, the situation where learners are having difficulty in realizing their intended meaning linguistically in an L2 is most likely to encourage them to stretch their IL system. Noticing a hole during output primes learners for future input and makes them ready to search for a linguistic form to fill the hole.

It should be noted that producing output is necessary for learners to notice a hole. That is, noticing a hole arises internally through the production processes and places learners in an ideal position to be ready for a relevant linguistic form. Therefore, noticing a hole during output contributes to the incorporation of linguistic forms.

### 3.2 Research Question 2

What cognitive activities does noticing a hole trigger? Table 3 shows the frequency of cognitive activities the participants of each group employed at Stage 2. The figures in the round brackets are the adjusted residuals. A positive adjusted residual reflects higher frequency of cognitive activities than can be expected and a negative adjusted residual reflects lower frequency of cognitive activities than can be expected.

<table>
<thead>
<tr>
<th>Cognitive activity</th>
<th>Lower Group</th>
<th>Middle Group</th>
<th>Upper Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lexical search</td>
<td>245 (5.1)</td>
<td>252 (-0.8)</td>
<td>209 (-4.0)</td>
</tr>
<tr>
<td>Semantic manipulation</td>
<td>37 (-0.5)</td>
<td>50 (-0.4)</td>
<td>54 (0.8)</td>
</tr>
<tr>
<td>Accessing lemmas</td>
<td>88 (-5.4)</td>
<td>195 (2.3)</td>
<td>190 (2.7)</td>
</tr>
<tr>
<td>Recollection of spelling</td>
<td>14 (1.0)</td>
<td>17 (0.7)</td>
<td>9 (-1.7)</td>
</tr>
<tr>
<td>Retrieval of construction</td>
<td>85 (0.4)</td>
<td>98 (-1.3)</td>
<td>109 (0.9)</td>
</tr>
<tr>
<td>Discourse arrangement</td>
<td>11 (-0.1)</td>
<td>8 (-2.2)</td>
<td>21 (2.3)</td>
</tr>
<tr>
<td>Comment on pre-selected forms</td>
<td>9 (-1.7)</td>
<td>23 (1.1)</td>
<td>20 (0.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>489</td>
<td>643</td>
<td>612</td>
</tr>
</tbody>
</table>

A test for equality was conducted and the results of statistical analysis show that the participants’ TL proficiency influences what cognitive activities are triggered by noticing a hole, $\chi^2 (12, N = 1,744) = 52.940, p = .000$.

The adjusted residuals for **lexical search** and **accessing lemmas** are greatly different between the three groups. The Lower group participants focus on retrieving lexical items more often than the Middle group and the Upper group participants, with the adjusted residual being 5.1. The Upper group and the Middle group participants, on the other hand, focus on how a lexical item should be used in a sentence than the Lower group participants, with the adjusted residuals being 2.7 and 2.3 respectively.

How does each cognitive activity contribute to the incorporation of linguistic forms? Do all the cognitive activities contribute to L2 learning equally? Table 4 shows how each cognitive
activity contributes to the incorporation of linguistic forms.

Table 4 Cognitive Activities and Their Effects on the Incorporation of Linguistic Forms

<table>
<thead>
<tr>
<th>Cognitive activity</th>
<th>Total N</th>
<th>N of incorporation</th>
<th>Incorporation rate(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lexical search</td>
<td>706</td>
<td>174</td>
<td>24.6</td>
</tr>
<tr>
<td>Semantic manipulation</td>
<td>141</td>
<td>48</td>
<td>34.0</td>
</tr>
<tr>
<td>Accessing lemmas</td>
<td>473</td>
<td>315</td>
<td>66.6</td>
</tr>
<tr>
<td>Recollection of spelling</td>
<td>40</td>
<td>16</td>
<td>40.0</td>
</tr>
<tr>
<td>Retrieval of construction</td>
<td>292</td>
<td>198</td>
<td>67.8</td>
</tr>
<tr>
<td>Discourse arrangement</td>
<td>40</td>
<td>10</td>
<td>25.0</td>
</tr>
<tr>
<td>Comment on pre-selected forms</td>
<td>52</td>
<td>23</td>
<td>44.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,744</strong></td>
<td><strong>784</strong></td>
<td><strong>45.0</strong></td>
</tr>
</tbody>
</table>

Among the seven cognitive activities, accessing lemmas and retrieval of construction contribute to the incorporation of more linguistic forms. A plausible explanation for this is that they are more likely to lead learners to think about how a lexical item should be used in a sentence, which leaves a strong trace in their memory and results in more learning.

3.3 Research Question 3

Do all learners equally benefit from the output-input activity irrespective of their TL proficiency? Table 5 shows the mean incorporation scores of the participants.

Table 5 Mean Incorporation Scores of Participants With Different Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>34</td>
<td>5.62</td>
<td>2.39</td>
</tr>
<tr>
<td>Middle</td>
<td>35</td>
<td>8.71</td>
<td>3.07</td>
</tr>
<tr>
<td>Upper</td>
<td>33</td>
<td>10.27</td>
<td>2.76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>102</td>
<td><strong>8.19</strong></td>
<td><strong>3.35</strong></td>
</tr>
</tbody>
</table>

Bonferroni’s multiple comparison shows that the effect of learners’ proficiency is statistically significant between Upper group and Lower group, and between Middle group and Lower group at an alpha level of .05.

For learners to process a noticed form for comprehension, they have to resort to their own TL knowledge. How much TL knowledge they have is a crucial determinant which affects the success of the process in which noticed input is converted into comprehended input. Therefore, learners with high proficiency incorporate more linguistic forms than learners with low proficiency through the output-input activity.
4. Conclusion

The ultimate goal of second language acquisition (SLA) research is to gain a better understanding of how learners’ IL system develops through certain activities and the mechanisms behind the developmental change. In other words, what SLA researchers have to do is to investigate how teachers’ intervention into learners’ thoughts and behaviors promote learning processes for intended outcomes.

What the present study has clarified are: (a) learners incorporate more linguistic forms into their IL system when they notice a hole, (b) noticing a hole triggers various cognitive activities and they have different effects on the incorporation of linguistic forms and (c) learners with high proficiency incorporate more linguistic forms into their IL system than learners with low proficiency through the output-input activity. The findings show that noticing a hole during output primes learners to be ready for a relevant linguistic form to fill the hole and that the output-input activity provides learners with an opportunity to process a relevant linguistic form to fill the hole for comprehension. If the processing is deep enough, the processed linguistic form is incorporated into their IL system, which can be regarded as an indication that learning has occurred.

The present study did not choose target linguistic forms in advance as it should be up to each participant to decide what linguistic forms are necessary to develop his or her IL system. It does not mean, however, that all linguistic forms are incorporated equally through the output-input activity. Linguistic forms differ in their complexity and abstractness. It seems reasonable to assume that different aspects of language, or different linguistic forms, are processed and stored differently. That is, syntax, lexicon and morphology are learned differently. Further research is required which takes characteristics of linguistic forms into consideration.

Notes
1) Henceforth, the product of Stage 1 is called Output 1.
2) Henceforth, the product of Stage 4 is called Output 2.

References


& J. Williams (Eds.), *Focus on form in classroom second language acquisition* (pp. 15-41). New York, NY: Cambridge University Press.


**Appendix: Directions for Guided Summarizing (Abridgment)**

【指示】
下記の指示に従って passage の要約を完成させてください。要約は5つの段落から構成されています。なお、括弧内の数字は各段落を何文で要約するかを示しています。指定されている表現を必ず使用して要約を完成させてください。

1. 第一段落（1文）
概要：世界中の国々は盲人の誘導を犬に行わせている。
国によってその犬の扱われ方は異なる。
使用するべき表現：depend, treat