The influence of the exposure frequency during implicit learning on the mere exposure effect

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Abstract

The relationship between the mere exposure effect and implicit learning has been discussed in several previous studies (Gordon & Holyoak, 1983; Tanaka et al., 2004). These previous studies tested the learning effect immediately after the learning phase as well as after a long interval following this phase. However, the learning effect of a stimulus repeatedly presented over a long period of time, such as an advertisement, has not been compared with that of the mere exposure effect. Thus, the effect of long-term implicit learning was examined in this study. In addition, we also examined which schedule was more effective by presenting each framework under conditions conducive to long-term implicit learning. This experiment was conducted with the artificial grammar learning paradigm generally used in research on implicit learning. Using this paradigm, in which an abstract grammatical rule is learned via more than a single exposure, this study employed the model used in the previous study conducted by Gordon & Holyoak to examine the influence of exposure frequency during implicit learning on the mere exposure effect.

Key words *: Mere exposure effect, Long-term implicit learning, Learning schedule*

Introduction

The mere exposure effect is known as a phenomenon that repeated exposure to a stimulus causes increased liking of that stimulus (Zajonc, 1968). One the other hand, the implicit learning indicates the learning that cannot be intentionally accessed from oneself about the learned a body of knowledge because there is no intention of having learned (Reber, 1967). These are examined in various experiments, and the relationship between the mere exposure effect and implicit learning has been discussed in several previous studies (Gordon & Holyoak, 1983; Tanaka et al., 2004). In the previous work of Gordon & Holyoak, participants were judged whether the strings followed the same rule as had the previous strings and how much they liked each strings by using the artificial grammar learning paradigm. As for the result of the experiment, it was suggested that learning the grammatical rule to implicitly be higher than the time not learned the liking to the letter strings. This shows that the mere exposure effect is caused even when the letter string stimulus following to an artificial grammar is presented. Moreover, it was shown to generalization is caused grammar based to the way in the structural mere exposure effect. In Tanaka's et al. previous study is examined that the processing level of stimulus in the mere exposure effect. This research examined the influence given to the mere exposure effect by the different abstraction level index with grammaticality, chunk, presentation stimulation of similarity by using the artificial grammar learning paradigm, and examined how stimulus was processed and judged in the mere exposure effect. These previous studies tested the learning effect immediately after the learning phase as well as after a long interval following this phase. However, the learning effect of a stimulus repeatedly presented over a long period of time, such as an advertisement, has not been compared with that of the mere exposure effect. Moreover, it is not examined that the influence of the operation of the presentation frequency in the experiment on the mere exposure effect. Thus, the effect of long-term implicit learning was examined in this study, it

was examined of employed the model used in the previous study conducted by Gordon & Holyoak to examine that learning effect when going in the learning phase of three times in every other week. In addition, we also examined which schedule was more effective by presenting each framework under conditions conducive to long-term implicit learning. The learning effect was examined when going only once in the learning phase in which the presentation frequency of stimulus was operated as a comparison with a long-term, implicit learning.

Methods

Participants. Sixty university students participated as observers (43 males and 17 females). They were from 19 to 24 years old.

Design. Grammaticality (grammatical, nongrammatical), length of letter strings (2 to 8) and learning schedule (rise, same, descent) were set as a within-subject factor. The factor of the learning schedule at short-term learning was assumed to be presentation frequency (1, 5, 9 times).

Materials. The letter strings was used to generated from 3 different artificial grammars. Letters used were 5 letters in each artificial grammar (Grammar 1 used the letters F, H, R, V, and X, Grammar 2 used the letters D, K, P, Y, and Z, Grammar 3 used the letters C, L, N, Q, and W). Twelve grammatical letter strings in each grammar were used in the learning phase (3 to 7 letters in length). An additional, 12 grammatical letter strings in each grammar were used in the test phase (2 to 8 letters in length). Similarly 12 nongrammatical letter strings of each grammar were also constructed for use in the test phase (3 to 8 letters in length). These closely matched the grammatical letter strings with respect to letter composition and overall length. Of the 12 nongrammatical strings, 6 violated the grammar by one misplaced letters, and 3 by two misplaced letters, 2 by four misplaced letters, and 1 letter strings was randomly ordered.

Procedure. The condition of doing the learning phase at intervals of one week (long-term learning) and the condition of doing the learning phase only once as baseline (short-term learning) was made and it experimented. In the long-term learning, the presentation frequency of the letter strings of each grammar is the same of the total, in one study, three condition of operating the presentation frequency of 1-5-9 times (rise), 9-5-1 times (descent) and 5-5-5 times (same) were set. In short-term learning, the presentation frequency of the letter strings of each grammar was different, and the presentation frequency was set three conditions of 1, 5, 9 times. The learning phase were presented 4 letter strings to each presentation. The presentation time is 20 seconds. After the learning phase, participants did the obstruction task for 5 minutes. Afterwards, participants were informed that they had just learned underlying rule in letter strings. After the instruction as to grammar rule, the test phase was done. Participants were shown 72 letter string, and they judged liking and grammaticality of the letter strings.. In the test phase, the presentation time was 10 seconds. The letter strings is seen for the first 5 seconds. In 5 seconds of the remainder, the judgment of the letter strings was done.

Results

Table 1 is shown mean grammaticality and liking rating for learning schedule (or presentation frequency) and grammaticality of letter strings. Moreover, Figure 1 is shown mean grammaticality rating in number of letters. We conducted 2 factors ANOVA of 3 (learning schedule or presentation frequency of character string)×2 (grammaticality of character string) in a grammatical judgment and liking judgment. In a grammatical judgment of the long-term learning, the main effect of the grammaticality of the letter string was significant ($p < .001$). The main effect of the learning schedule and interaction of learning schedule and grammaticality was not significant (both ns). In the short-term learning, both of the main effects of grammaticality of letter strings and presentation frequency were significant ($p = .003$; $p < .001$). Interaction of grammaticality and presentation frequency was not significant (ns). As a result, it was shown that if the total of the presentation frequency was the same, a different learning schedule did not influence a grammatical judgment. Moreover, it was shown that

Table 1: Mean grammaticality rating and liking rating for learning schedule (or presentation frequency) and grammaticality of letter strings. Standard deviation is shown in parentheses.

	Long-term learning		Short-term learning	
String	Grammaticality	Liking	Grammaticality	Liking
Grammatical				
Rise(9)	4.067(0.868)	4.558(0.674)	3.829(0.759)	4.154(0.699)
Same(5)	3.900(0.926)	4.417(0.770)	3.796(0.669)	4.209(0.638)
Down(1)	4.142(0.999)	4.529(1.048)	3.419(0.671)	4.219(0.757)
Nongrammatical				
Rise(9)	2.996(0.758)	4.092(0.756)	3.198(0.600)	3.700(0.688)
Same(5)	3.183(0.947)	3.862(0.688)	3.219(0.744)	3.815(0.549)
Down(1)	2.983(1.018)	3.708(0.767)	2.851(0.631)	3.867(0.646)

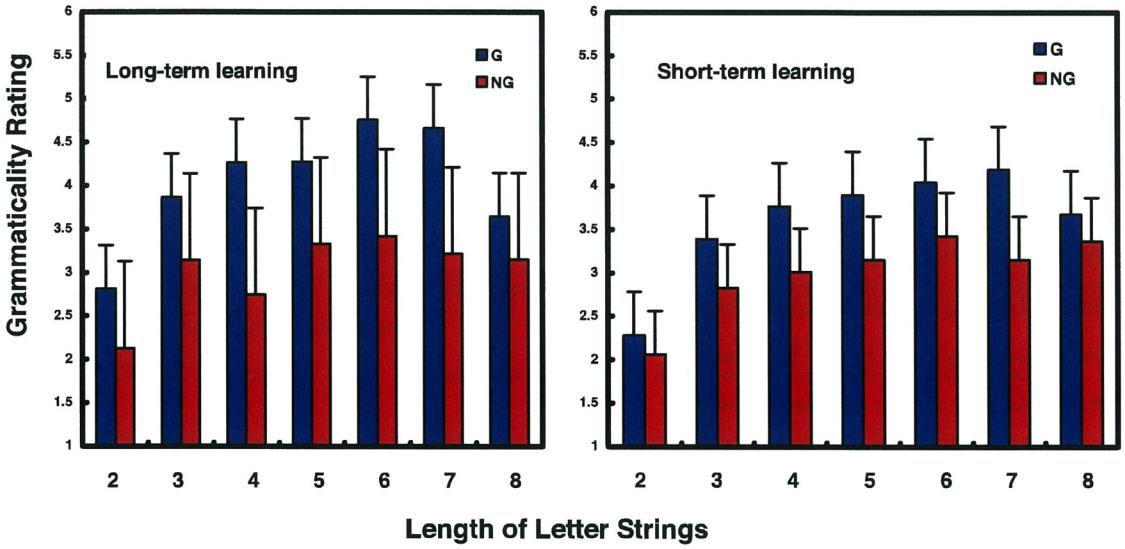

Figure 1: Mean grammaticality rating for number of letters in long-term and short-term learning.(G = grammatical strings; NG = nongrammatical strings.)

the difference of the presentation frequency influenced a grammatical judgment.

In a liking judgment of the long-term learning, the main effect of the grammaticality was significant ($p < .001$). The main effect of the learning schedule and interaction of learning schedule and grammaticality was not significant (both ns). As for short-term learning, the main effects of grammaticality were significant ($p < .001$). The main effects of presentation frequency and interaction of grammaticality and presentation frequency was not significant (both ns). As a result, It was shown that the liking of a grammatical letter strings was higher than that of the nongrammatical letter string. Moreover, it was shown that the learning schedule or the presentation frequency did not give the influence to the liking judgment.

Discussions

It was a purpose of this study to examine the learning effect in a long-term implicit learning. As a result of the analysis, the learning effect had not changed even if it changed the learning schedule. As a result, it was shown that learning effect was not influenced even if we present letter strings at what frequency when the presentation

frequency of the total is the same. Moreover, it was shown by the previous study that the mere exposure effect was caused even if they use the letter strings followed to an artificial grammar. However, it was not able to be shown from the result of this experiment clearly. It is suggested because the change in the liking into the letter strings was not seen in short-term learning when the presentation frequency is different. On the other hand, when letter strings were two letters, the participant showed the tendency to judge to the nongrammatical (see Figure 1). From this, it is thought that the entire grammar is not learned and letter string partial pattern was learned, there is a possibility of judging in that pattern. In a word, there is a possibility that the judgment by the family resemblance was done in each grammar. In this experiment, the row of a specific letter in each grammar was repeated occasional between the letter strings presented in the learning phase. By the repetition presentation of this overlap, It is thought that row of a specific letters was judged a grammatical rule. When the total presentation frequency in the long-term learning is the same, that can be shown because there is not so many difference in the result of the grammatical judgment between each grammar. Moreover, when the presentation frequency in the short-term learning is different, that can be shown to similar because there is difference in the result of the grammatical judgment between each grammar. Thus, it is thought that generalization based on a partial grammar occurred when judged in the pattern. Therefore, experiment that removed family resemblance effect by operating occurrence rate and similarity of pattern in letter string is necessary to clearly indicate that generalization was generated.

References

Gordon, P. C. & Holyoak, K. J. (1983). Implicit learning and Generalization of the "mere exposure" effect. *Journal of Personality and Social Psychology*, **45(3)**,492-500.

Reber, A. S. (1967). Implicit learning of artificial grammars. *Journal of Verbal learning and Verbal behavior*, **6**,855-863.

Knowlton, B. J. & Squire, L. R. (1996). Artificial grammar learning depends on implicit acquisition of both abstract and exemplar-specific information. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **22(1)**,169-181

Tanaka. D., Kiyokawa. S., Yamada. A., Dienes. Z. & Shigematu. K. (2008). Role of selective attention in artificial grammar learning. *Psychonomic Bulletin & Review*,**15(6)**,1154-1159.

Matsuda, K. & Kusumi, T. (2003). A long interval affects the mere exposure effect for the prototypes. The 25th Annual Conference of the Cognitive Science Society.