

Effects of Reflective Verbalization on Insight Problem Solving

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Abstract

This study investigated the effects of reflective verbalization on insight problem solving. In addition to a performance analysis, we examined the effects of reflective verbalization on the processes of insight problem solving based on the dynamic constraint relaxation theory (Hiraki and Suzuki, 1998). The results revealed that reflective verbalization disrupts insight problem solving and hampers the relaxation of the object-level constraint. Based on these results, it was concluded that the verbal overshadowing effects can be generalized with regard to higher-order domains that do not involve verbal processing.

Purposes

Previous studies have investigated the effects of verbalization on problem solving (e.g., McGeorge and Burton, 1989; Schooler, Ohlsson, and Brooks, 1993). It is important to investigate the effects of verbalization on implicit processes, since this can help to clarify the interaction between explicit and implicit processes.

Some researchers found the facilitative effects of verbalization on implicit processes (e.g., Berry, 1983; McGeorge and Burton, 1989). On the other hand, as pointed out by Reber (1989), verbalization might also impair these processes under some conditions. For example, Schooler et al. (1993) investigated the effects of verbalization on insight problem solving using some quiz-like problems and identified the disruptive effects of verbalization. Based on the results obtained, they concluded that the *verbal overshadowing effects* can be generalized with regard to higher-order domains that involve implicit processes.

Although the processes of insight problem solving per se can be regarded as being implicit, the task employed by Schooler et al. (1993) appears to involve verbal processing, which is an explicit process. Therefore, it is unclear whether verbal overshadowing can be generalized with regard to domains that involve fewer explicit processes. Thus, it is necessary to examine the effects of verbalization on the processes of insight problem solving in greater detail.

The first aim of this study is to clarify whether the verbal overshadowing effects can be generalized with regard to insight problem solving that does not involve verbal processing. The second aim is to conduct a detailed examination of the effects of verbalization on the processes of insight problem solving.

Method

Participants

Forty-five undergraduates from the University of Tokyo participated in this study. They were randomly assigned to either one of two conditions: *reflective verbalization* and *irrelevant verbalization (control)*.

Task

A T puzzle was used to address the abovementioned issues. The puzzle comprises four wooden pieces (Figure 1). The goal is to arrange these pieces such that they form the letter T.

Procedures

In both the conditions, the participants were presented with a sheet of paper with a 2/3-sized image of the letter T prior to solving the problem. Thereafter, they were asked to arrange the four wooden pieces in the shape of the letter T. They were notified about the following two rules prior to their beginning the experiment: (1) the time limit for the experiment was 15 min and (2) the sheet of paper would be taken away before they began working on the puzzle. In both the conditions, the participants were interrupted 5 min after they began working on the puzzle. Thereafter, the verbalization phase was introduced.

During the verbalization phase, those in the reflective verbalization condition were required to provide a 2 min detailed explanation on how they would solve the problem. Those in the irrelevant verbalization condition were asked to talk about their majors for 2 min in detail.



Figure 1: The T puzzle. As mentioned above, the goal is to arrange the four pieces such that they form the letter T.

Once all the participants had provided their explanations, they were instructed to resume solving the puzzle. The participants worked on the puzzle either until they had arrived at the correct solution or until the time limit—10 min—had expired. The entire course of the experiment was videotaped.

Results and Discussion

Since nine participants arrived at the correct solution prior to the verbalization phase, the data pertaining to these participants were excluded from the analysis.

A chi-square test revealed that the difference in the solution rate was marginally significant (chi-square (1) = 2.75, $p = .09$). The residual analyses revealed that the rate of “unsolved” under the reflective verbalization condition (73.7%) was higher than the expected value ($z = 1.67$, $p < .10$). On the other hand, the rate of “unsolved” under the irrelevant verbalization condition (47.4%) was lower than the expected value ($z = -1.67$, $p < .10$). Therefore, it can be said that reflective verbalization has disruptive effects on insight problem solving.

Next, we examined the effects of reflective verbalization on the processes of insight problem solving based on the dynamic constraint relaxation theory (Hiraki and Suzuki, 1998). In this theory, three types of constraints, i.e., the *object-level*, *relational*, and *goal constraints*, are hypothesized. This theory indicates that these constraints result in an impasse and the incremental relaxation of these constraints, which is largely due to failures, brings about qualitative transitions probabilistically. Therefore, we can regard insight problem solving as the process of constraint relaxation. More specifically, it can be said that the more frequently one deviates from these constraints, the more likely is it that one can obtain the solution.

With regard to the T puzzle, since people have a strong tendency to place the pentagon piece either vertically or horizontally, placing the pentagon piece diagonally was regarded as a violation of the object-level constraint. In terms of the relational constraint, people tend to connect the

pieces in order to fill the notch of the pentagon piece. Therefore, the index of the violation of the relational constraint was defined as connecting the pentagon piece with the other pieces without filling the notch.

In this study, with respect to the object-level constraint, a *move* was used as a unit of analysis. The move was operationally defined as a series of actions that were initiated when a participant moved any of the pieces and terminated when he/she stopped moving the pieces. Regarding the relational constraint, a *segment* was used as a unit of analysis. The segment was operationally defined as a series of actions that were initiated when a participant connected more than two pieces and terminated when he/she separated at least one of the pieces that were connected.

The rate of constraint violation in each condition was submitted to an analysis of variance (ANOVA) along with the condition (reflective verbalization or irrelevant verbalization: between participants) and time (before or after verbalization: within participants) as independent variables. The results showed that with respect to the object-level constraint, the interaction between the condition and time was marginally significant ($F(1, 34) = 3.59$, $p = .067$, see Figure 2). This interaction indicates that there was no change in the degree of relaxation of the object-level constraint under the reflective verbalization condition ($F(1, 34) = 0.04$, $p > .1$), whereas there was a significant increase in the degree of relaxation of the object-level constraint under the irrelevant verbalization condition ($F(1, 34) = 6.13$, $p < .05$). With regard to the relational constraint, neither the interaction nor the main effects were found to be significant. Therefore, it can be said that reflective verbalization hampers the relaxation of the object-level constraint.

It was concluded that the verbal overshadowing effects can be generalized with regard to the domains that involve fewer explicit processes than those addressed in Schooler et al. (1993). In addition, the process analysis revealed that reflective verbalization can impair constraint relaxation.

References

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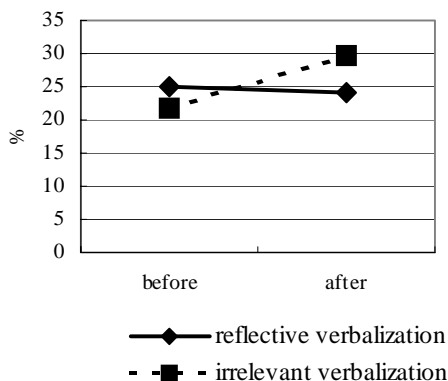


Figure 2: Mean violation rates of the object-level constraint in each condition before and after the verbalization phase.