The Effects of Implicit Structure on Explicit Learning

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Introduction

People have powerful sensitivities to statistical structure and covariation present in their environment, even in the absence of explicit awareness or the ability to verbalize the structure (e.g., Giddan & Eriksen, 1959). Reber (1967) coined the term *implicit learning* to describe "the process by which subjects respond to the statistical nature of a stimulus array." Although there is evidence for a neurological dissociation between implicit and explicit learning processes (e.g., Poldrack et al., 2001) there has been little investigation, however, into whether the implicit learning system *influences* our explicit attempts to learn.

Study Design and Procedure

In this study we modified a classic categorization task where participants are shown sets of shapes and asked to figure out the rule that sorts them. The novel aspect of the current study is that while participants attempted to (explicitly) learn the rule that determines category membership on one dimension (shape), the stimuli also varied along a second, *unattended* dimension (color). For one group of participants the unattended dimension followed a stable pattern and for another group the stimuli varied at random. This task was followed by a second rule-learning task where the focus was now on the previously unattended dimension (color). The critical question was whether the presence of a stable structure in the unattended dimension would affect the participant's ability to learn that structure once it became explicit.

All participants worked on solving two categorization rules and were presented with 100 sets of three colored shapes. Participants indicated whether they believed a set followed the rule or did not follow the rule, and the computer responded with positive or negative feedback.

The same two rules were used for all participants:

Shape Rule: *All the shapes in a set must be different*
Color Rule: *The first and third colors must be the same (symmetry)*

For half of the participants (the random condition) the color of the shapes used for the shape rule were selected randomly (i.e., no patterns). For the other half of the participants (the stable condition) the colors of *all of the sets used for the shape rule followed the pattern of the color rule*. In other words, every set of shapes shown to a participant in the stable group for the first rule had a symmetrical color pattern (e.g., blue-red-blue, green-green-green).

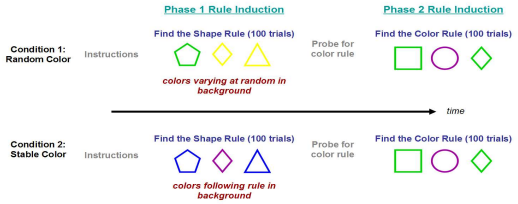

Figure 1: Study design.

To ensure that learning of the color rule was implicit, participants were asked if they noticed any patterns in the colors after they had completed the shape rule. If the participant said no, then we could assume that anything that had been learned about color was learned implicitly.

Results

Data was collected from 30 adult participants, 15 in each condition. We tracked whether each of the 100 responses the participant gave were correct or incorrect *in accordance with the rule*. Our analysis found a significant interaction for condition x rule x block of 25 trials, $F(3,26)=3.94$, $p<.05$. However, there were no differences between conditions on the second rule (color).

These results indicate that a stable implicit structure aids concurrent explicit learning, but that that implicit learning did not transfer to subsequent explicit learning, even though it was highly relevant. One interpretation of this result is that there actually was no implicit learning—it was simply that it was easier for participants to learn in a more stable, less noisy environment. An alternative interpretation is that implicit learning can affect explicit learning, but that it didn't in this case because participants viewed the two rules as separate tasks and did not know that they should transfer.

References

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