The effect of response representation in a task switch

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We investigated the role of response mapping, or the effect of response representation, with the assumption that visual processing needs not only a stimulus representation but also a response representation. The participants were required to react to both the prime and the probe displays with a Go/No-Go response. We examined response repetition which facilitated performance and task switching which caused a cost in performance. The main result indicated that a response for the prime display inhibited a response to the target for the probe display. This suggests that the response mapping affected a response to the target even when participants gave only a response representation without a translating action or motor response.

Key words: response mapping, representation, task switch

Introduction

Recent studies have noted that response representation, in addition to stimulus representation, is important for visual processing (e.g., Hommel, 1998). We have investigated the role of response mapping, or the effect of response representation, by manipulating response repetition and task switching. In switching between two different tasks provided by the same stimuli, response repetition could lead to response slowing. The stimulus representation might be unchanged with repeating the same stimuli whereas the response representation might change. By repeating the same tasks response repetition could lead to facilitation. The cost and benefit might allow us to examine response mapping and representation.

Method

Participants Twelve volunteers participated in Experiment 1 and eight in Experiment 2.

Stimuli A typical trial consisted of a display for fixation (a small circle), prime (three squares), and probe (Figure 1). The target stimulus in the probe display was either an arrow pointing to the left ($<$), the right ($>$), or the left and right ($<$ $>$), or a bar ($-$).

Procedure Each trial began with a fixation display for 1000 ms. Immediately after this display the prime was presented until there was a response (Experiment 1), or for 1000 ms (Experiment 2). Termination of the prime display was then followed by a response-stimulus interval (RSI) of a blank for 1500 ms. RSI of a blank was followed by the probe either until a response or for 5000 ms. Fixation for the next trial followed the blank for 3000 ms after termination of the probe. In Experiment 1, the participant’s primary task was to react to a location or locations, with a square or squares, by pressing keys. In Experiment 2, the task was to make a

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Figure 1. An example of a stimulus sequence.
decision without making motor responses. For the
probe stage the secondary task (a Go/No-Go task)
was to make a decision of either a whole switch (<-
->), a partial switch (<--) or non-switch (--),
and to respond to the target stimulus based on
the prime response. In both switch conditions, for
the probe, the participants reacted to a location or
locations, to which they did not react with a square or
squares, for the prime. In the non-switch condition,
the participants reacted to a location or locations,
to which they did react with a square or squares, for
the prime. The prime and probe responses required
the participants to react as quickly as possible, and with
minimum error, by pressing keys which corresponded
to the three locations. The reaction times (RTs) to
the target in the probe were measured.

**Prediction** We predicted that a repetition of a
whole or partial response would influence the pre-
action effect and a task switch cost. The pre-action
effect is due to the effect of response mapping or
representation of the prime. The presence of a
response for the prime would affect a response to the
target for the probe, compared with an absence of
response. The task switch cost is the difference in a
participant's performance for the number of switches
(i.e., whole, partial, and non-switch).

**Results and Discussion**

In Experiment 1, a pre-action effect was observed
(Table 1). The presence of a response for the prime
delayed RTs to the probe target, compared with an
absence of a response. This result suggests that the
response mapping for the prime inhibited a response
to the target for the probe. Moreover a switch cost
did not occur. These results might be due to the
participant making motor responses to the prime. In
particular, motor responses for the prime might have
delayed the response for the probe and eliminated a
difference in performance between the whole, partial,
and non-switch conditions.

In Experiment 2, we investigated whether response
mapping for the prime would depend on an action
with a motor response or on action representation
without a motor response. The stimuli and procedure
were the same, except for the prime response. The
participants made only a decision about a square or
squares in the prime. As a result, the patterns for the
RTs were the same as those in Experiment 1. How-
ever the probe stimulus was an arrow. When the
participants responded to the target for the probe,
based on the prime location, the arrow did not point
directly to the probe location. In another study (Hibi
& Yokosawa, 2002) instead of an arrow the probe
stimulus used the same square as the prime stimulus.
The results differed from those in the present study in
the occurrence of a switch cost.

The results highlight that response mapping for the
prime inhibited response to the target for the probe
even when the participants did not translate
responses into movement. The participants might
then have only response representation. Moreover,
when the target stimulus indirectly pointed to the
probe location a switch cost did not occur. We
propose that a switch cost might occur when the
target stimulus has direct spatial information of the
square presentation. The results suggest that a task-
set reconfiguration for a task switch reflects response
repetition and activation on the stimulus location.

**References**

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