P9-Adaptive control of automatic imitation

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Laboratory evidence for automatic imitation comes from studies showing that action execution is disturbed by the concurrent observation of a different (incompatible) action. The present study investigated the inhibitory mechanisms involved in the regulation of automatic imitative responses tendencies. Spatial compatibility effects and anatomical compatibility effects (indexing automatic imitation) were tested in different tasks. Our results revealed sequential modulations of compatibility effects in both tasks: compatibility effects on a given trial were reduced when incompatibility was encountered in the preceding trial. Thus, adaptive control mechanisms modulate the expression of automatic imitation.
Keywords: automatic imitation; control; action perception

INTRODUCTION

Recent studies showed that observing a movement primes the execution of that movement, thereby interfering with the execution of another movement (for review, see Heyes, 2010). This human copying tendency is seen as a special case of imitation, namely automatic imitation. Mechanisms are needed to prevent automatic imitation in situations where the observed action leads to the activation of a motor representation that is not intended.

Inhibitory mechanisms of dominant response tendencies are commonly tested using Stroop-like and Simon tasks. A common finding is that reaction times (RTs) are shorter when stimulus and response features are compatible rather than incompatible. In Simon tasks, spatial compatibility effects on a given trial are strongly attenuated when response conflict (i.e. spatial incompatibility) was also encountered on the preceding trial (e.g., Stürmer et al., 2002). This sequential modulation is thought to reflect top-down mediated adaptive control mechanisms (Botvinick et al., 2001).

The present study investigated the functional properties of the inhibitory mechanisms required for regulation of automatic imitation. Spatial compatibility effects (Simon effect) and anatomical compatibility effects (indexing automatic imitation) were tested in different tasks. Participants observed index or middle finger movements. One task required to respond according to the identity of the moving finger and the other according to the spatial location of the finger movement. Our objective was to test whether anatomical compatibility effects showed trial by trial modulation, hence showing adaptive control mechanisms, like those evidenced in Stroop-like situations and Simon tasks.

METHODS

Participants. A total of 14 consenting, healthy volunteers (2 females; mean age 20; all right handed) took part in the experiment.

Task and Stimuli. The participants' index and middle fingers of the right hand rested on two keys of a response box. In each trial, a picture of a right or left hand was displayed on a screen, followed by a picture of the hand with either index or middle finger moved down (producing apparent motion). In the Imitation task, the participants were required to press the key on the response box with their index finger if the index finger moved down and the second key with their middle finger if the middle finger moved down. In the Spatial task, participants responded according to the location of the observed movement (relative to the center of the screen), by pressing the key with their index finger if the observed movement was on the left side of the screen, and by pressing the key with their middle finger if the observed movement was on the right side of the screen (Figure 1). 240 trials were performed in each task. The dependent variables were RT and error rate.

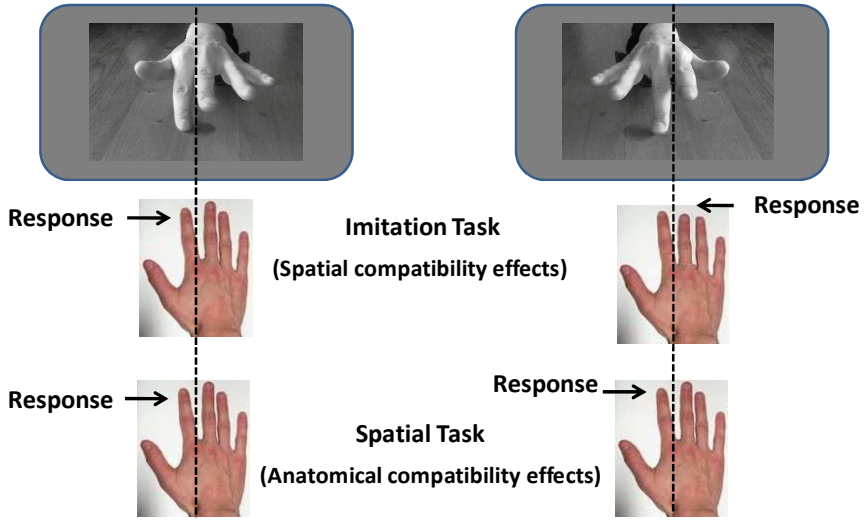

Figure 1. Experimental design and sample stimuli. In the Imitation task, the response was either *spatially* compatible or incompatible (left and right side of the figure, respectively) with the observed movement. In the Spatial task, the response was either *anatomically* compatible or incompatible with the observed movement.

RESULTS

Because the error rates were very small, the analyses focused on RT data. In both tasks, each trial was classified according to current compatibility and compatibility in the preceding trial (Figure 1).

Mean correct RTs were submitted to an ANOVA with Compatibility on trial N (compatible vs. incompatible), Compatibility on trial N-1, and Task (Spatial vs. Imitation), as within-subject factors. The ANOVA revealed a significant interaction between Compatibility on trial N and Compatibility on trial N-1: the compatibility effects were strongly attenuated following an incompatible trial ($F(1,13) = 31.46$, $p < .001$). Importantly, this interaction was not modulated by the Task factor ($F = 2.36$, $p > .1$). Thus, in both tasks, incompatibility in trial N-1 reduced incompatibility in trial N.

DISCUSSION

In line with previous findings, the sequential modulation of spatial compatibility effects reveals adjustments of control processes required to overcome response conflicts (Botvinick et al., 2001; Stürmer, et al., 2002). The anatomical compatibility effect reveals automatic imitation: perceiving an action primes the execution of that same action (Berthental et al., 2006; Heyes, 2011). The presence of sequential modulation of anatomical compatibility effects demonstrates top-down regulation of automatic imitative responses tendencies. These processes could be specific or non-specific to automatic imitation. In addition, the locus of this regulation, in the perception-action coupling process, remains to be determined.

REFERENCES

Bertenthal, B. I., Longo, M. R., & Kosobud, A. (2006). Imitative response tendencies following observation of intransitive actions. *Journal of Experimental Psychology: Human Perception and Performance*, *32*, 210–225.

Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. C. (2001). Conflict monitoring and cognitive control. *Psychological Review*, *108*, 624–652.

Heyes, C. (2011). Automatic imitation. *Psychological Bulletin*, *137*, 463-483.

Stürmer, B., Leuthold, H., Soetens, E., Schröter, H., & Sommer, W. (2002). Control over location-based priming in the Simon task: Behavioral and electrophysiological evidence. *Journal of Experimental Psychology: Human Perception and Performance*, *28*, 1345-1363.