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Motor and cognitive integration: Effect of bilateral behaviors on judgment☆

Joël Cretenet [a], Etienne Mullet [b], Vincent Dru [a,*]

[a] Université Paris Ouest Nanterre La Défense, France
[b] Ecole Pratique des Hautes Etudes, France

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ABSTRACT

Performing approach vs. avoidance behaviors (arm flexion vs. arm extension) on the one hand, and lateralized peripheral activations (left side vs. right side) of the motivational systems of approach vs. avoidance, on the other hand, have been shown to impact on cognitive functioning (Cretenet, & Dru, 2009), mainly in judgment tasks. When a unilateral motor congruent behavior; that is, a behavior that activates the same motivational system (e.g., flexion of the right arm) was performed during a judgment task, participants' use of complex, interactive information integration rules was facilitated. No effect was, however, found when simpler, additive rules were involved (Mullet, Cretenet, & Dru, 2014). Three experiments are reported here that examined the effect of bilateral motor behaviors (e.g., flexion of the right arm and extension of the left arm) on the implementation of information integration rules. In Studies 1 and 2, two judgment tasks similar to the ones used by Mullet et al. (2014) were used: (a) a complex task in which participants judged a person's attractiveness from personality information, and (b) a simpler task in which they attributed blame according to bad deeds. It was found that similar motor behaviors performed by the two arms (e.g., flexion of both arms), in contrast to dissimilar ones, facilitated the use of complex, interactive information integration rules. No effect was found in the case of simpler integration rules. In Study 3, these results were replicated in a judgment task in which the complexity of the integration rule varied depending on the instructions given. Overall, when bilateral motor behaviors were performed during judgment, facilitation in the use of complex integration rules no longer depended on motivational congruence as in the case of unilateral motor behavior. It depended on symmetry/similarity of behaviors.

1. Introduction

The present study examined the way information about a stimulus (e.g., a person's attributes) and motor activation at the time of judging (e.g., left arm flexion) are integrated during a judgment process (e.g., judging the person's attractiveness). The present study differed from previous studies into motor and cognitive integration in human judgment in that: (a) information about the stimulus was complex; that is, it was provided by several independent pieces of information, and (b) motor activation was also complex; that is, it corresponded to the activation of both arms.

1.1. Information integration rules for judging

The simplest type of judgment process is when only one piece of information is available, and no specific motor activation is produced. In this case, the judgment process simply consists in associating a value to the piece of information, in terms of the kind of judgment that is expected (Anderson, 2013). For example, if one is told that a person called Claudia is concerned by others' well being, and if the judgment task is to judge Claudia's attractiveness, then the response is straightforward: Claudia will be judged as rather attractive.

Researchers have examined judgment processed in the case where two (or more) pieces of information were available, and no specific motor activation was produced. In the case of two pieces of information, and according to Anderson (2008, 2013), the judgment process consists (a) in associating a value to the first piece of information, (b) in associating a value to the second piece of information, and (c) in integrating both values into a unitary response, in terms of the kind of judgment that is expected (e.g., a person's attractiveness). Previous studies have shown that, in this kind of situation, information integration processes obeyed simple cognitive rules such as addition, multiplication and averaging (Anderson, 2013). In an early study, Birnbaum (1974) showed that when participants were instructed to judge a person's attractiveness according to two pieces of information about this person, they integrated the information in a complex, interactive way, which is graphically depicted in the left part of Fig. 1. In this panel, the curves ascend: The higher the value of the first piece of information, the higher

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* Corresponding author.
E-mail addresses: jcretenet.up10@gmail.com (J. Cretenet), etienne.mullet@wanadoo.fr (E. Mullet), dru@u-paris10.fr, druvincent@wanadoo.fr (V. Dru).

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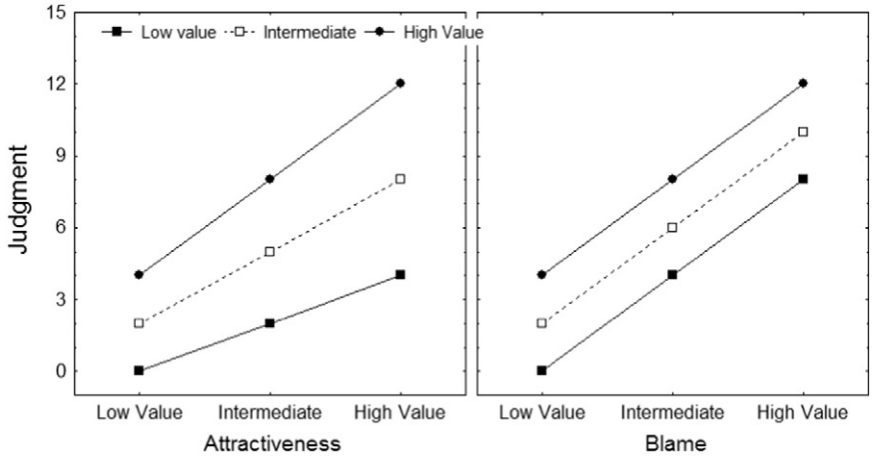

Fig. 1. Two patterns of responses associated with different integration rules (conjunctive on the left, additive on the right).

the attractiveness judgment. The curves are clearly separate: The higher the value of the second piece of information, the higher the attractiveness judgment. Curves diverge on the right: The effect of one piece of information on judgment depended on the level of the other piece of information. It was this divergence of curves that attested the interactivity of the judgment process in this study. Other studies have found simpler information integration processes, like the one that is shown in the right panel of Fig. 1 (e.g., Leon, 1982). In this case, the curves were parallel; that is, the effect of both pieces of information was additive.

1.2. Motor effects on judgment

Researchers have also studied the effect of motor activation on judgment. In some studies, only one piece of information was available and only one aspect of motor activation was examined: arm flexion vs. arm extension. In this case, as a specific motor activation was produced at the time of judging, then the judgment process consists (a) in associating a value to the piece of information, (b) in "interpreting" the information that comes from the arm considered, and (c) in integrating both elements into a unitary response, in terms of the kind of judgment that is expected. Previous studies have shown that some bodily cues (e.g., arm extension) can activate respectively the systems of approach or avoidance linked to affective valence, triggering inclinations that operate independently from affect (e.g. Cacioppo, Priester, & Berntson, 1993) and self-perception mechanisms. For example, Centerbar and Clore (2006) found that motor approach (vs. avoidance) determined more positive evaluations of stimuli when these stimuli were respectively compatible (positive vs. negative) with the behavior performed.

In other studies, another aspect of motor activation was examined: whether activation was produced by the left or by the right hand. For example, Schiff and Lamon (1989, 1994) examined how unilateral muscle contraction (left side vs. right side) leads to different evaluations of stimuli. Previous research has suggested that more positive evaluations were associated with activation of the left cerebral hemisphere, and more negative evaluations were associated with activation of the right hemisphere (Davidson, 1984, 1992; Davidson, Ekman, Saron, Senulis, & Friesen, 1990). This cerebral asymmetry, located in the anterior prefrontal region (Sobotka, Davidson, & Senulis, 1992; Sutton & Davidson, 1997), reflects two basic response systems in the brain, which are associated with either approach or withdrawal. Schiff and Lamon (1989, 1994) found that right-handed participants contracting muscles in their left hand; that is, stimulating the right hemisphere — linked to the avoidance system, reported more personal negative feelings, whereas participants contracting muscles in their right hand; that is, stimulating the left hemisphere — linked to the approach system, experienced more positive feelings.

In summary, previous studies have shown that, depending on the type of movement — flexion vs. extension or right arm vs. left arm -, the final response was higher or lower than the one that would be expected without the presence of specific motor activation. In other words, motor activation influences the final response. These findings supported the idea that motor activation conveyed information in terms of approach–avoidance that was integrated with the given piece of information at the time of judging.

1.3. Motor integration in judgment tasks

In yet other studies, researchers have assessed the combined effect of different aspects of motor activation, namely the effect of flexion–extension in combination with the effect of laterality on judgment when only one piece of information was available. In this case, where one piece of information (e.g. Chinese stimuli, facial expression or picture) was available and complex motor activation was systematically produced, the judgment process consisted (a) in associating a value to the piece of information, (b) in interpreting and combining the information that comes from the arm, and (c) in integrating both elements into a unitary response. Cretenet and Dru (2004) demonstrated that when right arm flexion was performed; that is, when there was congruence of an approach–approach type in the motivational system, judgments were more positive. When left arm extension was performed, that is, when there was congruence of an avoidance–avoidance type, judgments were also more positive. In contrast, when right arm extension was performed; that is, when there was incongruence of an approach–avoidance type or when left arm flexion was performed; that is, when there was incongruence of an avoidance–approach type, judgments were more negative.

What these studies illustrated was that motor integration did not obey an additive rule of the kind: Laterality + Flexion/Extension. Motor integration was interactive: (a) when motor activation was congruent in terms of what each component meant at a motivational level, the judgment was more positive and (b) when motor activation was incongruent, the final judgment was more negative.

1.4. Motor and cognitive integration

Finally, researchers have assessed the combined effect of different aspects of motor activation on judgment when two pieces of information (not just one) were available (Mullet, Cretenet, & Dru, 2014). In this case, the judgment process consisted (a) in associating a value to each piece of information, (b) in interpreting and combining the information that comes from the arm, and (c) in integrating all the information — cognitive and motor — into a unitary response. In this higher-level case, several judgment processes can be envisioned but