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Being Moved: Valence Activates Approach-Avoidance Behavior Independent of Evaluation

and Approach-Avoidance Intentions

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Abstract

Theories from diverse areas of psychology postulate that affective stimuli facilitate approach and avoidance behavior because they elicit motivational orientations that prepare the organism for appropriate responses. Recent evidence casts serious doubt on this assumption. Instead of motivational orientations, evaluative coding mechanisms may be responsible for the effect of stimulus valence on approach-avoidance responses. Three studies tested contrasting predictions derived from the two accounts. In support of motivational theories, stimulus valence facilitated compatible approach-avoidance responses even though participants had no intention to approach or to avoid and the valence of the response labels was dissociated from the approach-avoidance movement (Study 1). This was also true when participants were not required to process the valence of the stimuli (Studies 2a and 2b). These findings are at odds with the evaluative coding account and support the notion of a unique automatic link between the perception of valence and approach-avoidance behavior.

Recognizing good or bad stimuli in the environment and acting accordingly certainly is one of the most important regulatory needs of organisms. Particularly, quickly escaping from dangers and grasping opportunities to gain rewards are part of the behavioral repertoire that ensures survival in environments with scarce resources and threatening foes. Accordingly, numerous classic and current theories from diverse areas of psychology suggest that approach and avoidance behaviors are driven by specialized systems which evolved to efficiently process valence and trigger functional responses (e.g., Davidson, Ekman, Saron, Senulis, & Friesen, 1990; Darwin, 1872; Dickinson & Dearing, 1979; Gray, 1994; Lang, Bradley, & Cuthbert, 1990; LeDoux, 1996; Lewin, 1935/1967; Öhman, 1987; Strack & Deutsch, 2004). In this view, valence processing and the resulting motivational tendencies are attributed a special status among psychological processes, because they are so fundamental for an organism's survival (cf., Bargh, 1997; Zajonc, 1980). Recently, this position has been questioned both on theoretical and empirical grounds (Eder, Hommel, & De Houwer, 2007). From this perspective, valence has no special status among other stimulus features such as size, color, and location. Correspondingly, approach and avoidance behaviors may not be regulated by distinct motivational mechanisms. Instead, they are seen as behaviors that follow general principles of action control (Lavender & Hommel, 2007; Eder & Rothermund, 2008).

One current manifestation of this overarching debate centers on the observation that perceiving positive stimuli facilitates simple approach behaviors (e.g., pulling a lever toward the body or moving a figure on the screen toward the stimulus) whereas perceiving negative stimuli facilitates simple avoidance behaviors (e.g., pushing a lever away from the body or moving a figure away from the stimulus; Chen & Bargh, 1999; De Houwer, Crombez, Baeyens, & Hermans, 2001). Traditionally, such compatibility effects were interpreted as being caused by motivational orientations immediately triggered by automatic stimulus evaluations (Chen & Bargh, 1999; Neumann, Förster, & Strack, 2003). Recently, however, some researchers have argued that these compatibility effects may simply follow from general

mechanisms of action control that are not specific to valence. The theory of event coding (*TEC*; Hommel, Müsseler, Aschersleben, & Prinz, 2001) describes such a general mechanism of action control. According to the TEC, actions are represented by feature codes that refer to the anticipated distal effects of the action. Further, actions and perceived stimuli are represented in a common representational domain. As a consequence, response execution is facilitated when the stimulus and the action representation share a large number of features. The very same principle was suspected to be responsible for facilitation of approach-avoidance behaviors. Particularly, valenced stimuli may facilitate compatible approach-avoidance behaviors because of an overlap of stimulus-valence and response-valence (Eder & Rothermund, 2008; Lavender & Hommel, 2007). In this view, response-valence stems from the intentional labeling of the responses in evaluative terms. Labeling a behavior as approach (avoidance) attaches positive (negative) valence to the behavior representation. The evaluative codes of the behavior representations may then overlap with stimulus valence and thus cause approach (avoidance) to be faster with positive (negative) stimuli. Note, that this view predicts that *any* behavior that is represented with evaluative codes will be facilitated by valence-congruent stimuli. In contrast, motivational theories share the assumption that valenced objects trigger *functional* responses, that is responses changing the distance between the self and the object in the service of fundamental needs like survival and nurturance. Furthermore, the evaluative coding account predicts facilitation of responses only if the responses are intentionally labeled in an evaluative way (Eder & Rothermund, 2008, p. 265). According to the motivational view, however, approach-avoidance responses are facilitated independent of an intentional labeling of the responses in terms of approach-avoidance.

To test the evaluative coding hypothesis against the motivational view, Eder and Rothermund (2008) studied joystick-movements that were either labeled in terms of approach-avoidance (i.e., move toward vs. away) or labeled in an evaluative way, but unrelated to approach-avoidance (i.e., move upward vs. downward). According to

independent tests, the labels upward and downward are evaluated positively and negatively, respectively. Consequently, the evaluative coding hypothesis predicts that upwards and downwards movements in response to valenced stimuli should generate the same kind of compatibility effects as approach and avoidance movements. From a motivational perspective, however, no response facilitation should occur under these conditions. The results were strongly in support of the evaluative coding hypothesis: positive (negative) stimuli facilitated movements that were described with positive (negative) labels, irrespective of whether the labels referred to approach-avoidance or to upward-downward and irrespective of the concrete movement. As such, the observations of Eder and Rothermund may suggest that the often observed compatibility effects between stimulus valence and approach-avoidance behavior are a consequence of general mechanisms of action control that are not specific to valence or approach-avoidance. If this interpretation is valid, it seriously questions the widespread idea that valenced stimuli automatically induce specific motivational states of approach and avoidance and therefore facilitate corresponding behaviors.

The present studies aimed at providing a more sensitive test of the motivational view than those of Eder and Rothermund (2008). In the latter studies, the intentional labeling of joystick movements fully determined the compatibility effects. We suspect that the movement itself had no impact because joystick movements are ambiguous regarding the direction of distance-change. Specifically, the same movement can mean approach or avoidance depending on whether the self or the object serves as the reference point (Seibt, Neumann, Nussinson, & Strack, 2008; see also Markman & Brendl, 2005). Therefore, effects in the joystick task might necessarily depend on the labeling of the responses. If this reasoning is correct, the joystick task does not allow a sensitive test of potential effects of motivational orientations, which should occur independent of labeling.

To overcome this limitation, we used an adapted version of the manikin task of De Houwer et al. (2001). In this task, participants move a figure on a computer screen toward or

away from a stimulus by pressing the up and down keys on a keyboard. The stimulus always appears centered, whereas the figure either appears in the upper or lower half of the screen. In the present experiments, we instructed our participants to move the manikin upward (positively labeled response) or downward (negatively labeled response) without making a reference to approach/avoidance or toward/away. Depending on the starting position of the figure, upward and downward movements implied moving toward or away from the stimulus. Thus, motivational compatibility effects can be tested in addition to and independently from evaluative coding effects (see Figure 1). The manikin task has the advantage that the responses are unambiguous regarding distance-change (cf. Krieglmeyer & Deutsch, in press), and thus effects on approach-avoidance responses can be tested independent of labeling the responses in terms of approach-avoidance. From the perspective of motivational theories, participants should be faster to move the manikin toward positive and away from negative words than vice versa, even though they did not intend toward-away movements but upward-downward movements and even though the valence of the response labels was dissociated from the approach-avoidance direction. In addition, we expected to replicate the evaluative compatibility effect (i.e., faster when instructed to move upward for positive and downward for negative words) that has been demonstrated by Eder and Rothermund (2008).

STUDY 1

Method

Participants

Fourty-seven non-psychology students (20 female) from the University of Würzburg took part in the study in exchange for a chocolate bar. The mean age was 23.7 years ($SD = 2.9$).

Materials and Procedure

We used 30 positive and 30 negative nouns as test stimuli and 4 positive and 4 negative nouns as practice stimuli (Hager & Hasselhorn, 1994; Klauer & Musch, 1999). The manikin was a picture of a simple figure of about 2.8 cm length. Participants were instructed to imagine being the figure and to move with that figure by pressing the up and down keys of the keyboard. Following De Houwer et al. (2001), a trial started with the figure appearing either in the upper or lower half of the screen. 750 ms later, a word was presented in the center of the screen. Participants were instructed to move with the figure as quickly and accurately as possible upward (downward) when the word was positive (negative), or vice versa. They had to press the respective key three times to move the figure across the screen. Depending on the initial position of the figure and the movement direction, the figure either stopped at the edge of the screen or close to the word. The screen turned black 50 ms after the third key-press. In case of an incorrect response, an error message appeared immediately after the first key-press for 500 ms. The time between the onset of the word and the first key-press served as the dependent variable. Participants completed one evaluation compatible (positive-upward, negative-downward) and one evaluation incompatible block (positive-downward, negative-upward), each consisting of 60 trials that were presented in random order. Each block was preceded by eight practice trials. The order of the blocks was counterbalanced across participants.

Results

Incorrect responses (6.0%) and latencies below 150 ms and above 1500 ms[2] (4.8% of the correct responses) were discarded. We submitted the response latencies to a 2 (evaluative compatibility) X 2 (motivational compatibility) analyses of variance (ANOVA) for repeated measures[1]. Responses in the evaluation compatible block (positive-upward, negative-downward) were faster than responses in the evaluation incompatible block (positive-

downward, negative-upward), $F(1,46) = 14.87$, $p < .001$, $\eta^2 = .24$ (see Table 1). In addition, responses on motivation compatible trials (toward positive, away from negative) were faster than responses on motivation incompatible trials (away from positive, toward negative), $F(1,46) = 8.61$, $p = .005$, $\eta^2 = .16$. Furthermore, the ANOVA revealed a significant interaction of evaluative and motivational compatibility, $F(1,46) = 4.74$, $p = .035$, $\eta^2 = .09$. Simple comparisons indicated a motivational compatibility effect (faster toward positive and away from negative words) only in the evaluation compatible block, $t(46) = 4.33$, $p < .001$, but not in the evaluation incompatible block, $t < 1$.

Discussion

In line with the evaluative coding account and replicating Eder and Rothermund (2008) valence facilitated responses that were labeled in an evaluatively compatible way (upward-downward). More importantly and supporting the motivational view, valence facilitated behaviors that resulted in a compatible distance change even though participants mentally represented their behaviors as up and down movements, with up and down movements being independent of actual distance-change. Thus, a motivational compatibility effect was observed even though participants did not have the intention to approach or avoid and even though they did not label their behaviors in approach-avoidance terms. The latter finding is at odds with the evaluative coding account, but can be explained by motivational theories.

Interestingly, valence facilitated compatible approach-avoidance responses only when the valence of the upward-downward response labels was congruent with the stimulus valence. A possible explanation for this finding is that during the evaluation incompatible block (i.e., positive-downward, negative-upward), participants had to deploy more executive control than during the evaluation compatible block. In the incompatible block, participants had to overcome automatically activated but incorrect response tendencies, whereas in the compatible block they could simply go with their immediate response tendencies. It seems

possible that the deployment of executive control might erase all bottom-up modulations of the responses, including modulations by motivational orientations. This explanation implies that the motivational compatibility effect should be independent of evaluation compatibility when evaluation compatible and incompatible trials are intermixed so that the deployment of executive control remains more constant throughout the experiment. This hypothesis was addressed in the following Studies.

STUDIES 2A AND 2B

Studies 2a and 2b tested if the motivational and evaluative compatibility effects depend on evaluation intentions. To this end, participants responded with upward-downward movements according to the grammatical category of words. Stimulus valence was varied independent of grammatical category. Whereas the motivational view assumes facilitation of approach-avoidance responses even if stimulus valence is not intentionally processed (Chen & Bargh, 1999), the evaluative coding account predicts evaluative compatibility effects to be reduced when participants do not need to evaluate. Lavender and Hommel (2007) even failed to find effects of stimulus valence under these conditions. To examine the generality of the findings, we conducted two studies with different methods. In Study 2a, participants moved a manikin similar to Study 1. In Study 2b, participants moved a dot on the screen upward or downward by moving a pen on a writing tablet.

Method

Participants

In Study 2a, 94 non-psychology students (45 female) from the University of Würzburg participated in exchange for a chocolate bar. The mean age was 23.6 years ($SD = 4.3$). In Study 2b, 34 undergraduate students (27 female) from various faculties at Ghent University

participated in exchange for €5. All were native Dutch speakers with a mean age of 20.2 years
($SD = 2.0$).

Materials and Procedure

Study 2a. We used 20 positive and 20 negative nouns as well as 20 positive and 20
negative adjectives as test stimuli. The adjectives were taken from Wentura, Rothermund, and
Bak (2000). The nouns were the corresponding nouns to the adjectives. Practice stimuli were
two words of each stimulus category. The procedure was the same as in Study 1 with the
following exceptions. Participants were instructed to move with the figure upward
(downward) when the word was a noun (adjective), or vice versa. The mapping between
grammatical category and upward-downward response was counterbalanced across
participants. Following eight practice trials, participants completed 80 test trials in random
order.

Study 2b. Stimuli were eight positive and eight negative nouns as well as eight positive
and eight negative adjectives (Hermans & De Houwer, 1994). Five other positive and
negative nouns and adjectives were chosen as practice stimuli. Pen movements were recorded
using a pen and a horizontally placed digitizer (WACOM writing tablet), designed to measure
pen pressure. At the start of each trial, three red rectangle bars of 1.5 cm height and 8 cm
width appeared on the screen, positioned at the top, center, and bottom of the screen.
Additionally, a blue circle appeared either in the upper or lower half of the screen (midway
between two rectangles), accompanied by a 200 ms warning tone. Participants were instructed
to place the cursor (an orange dot) in the blue circle by moving the pen on the digitizer. A
word appeared in the central rectangle 750 ms after they had placed the pen on the starting
position, while at the same time the blue circle disappeared with the orange dot remaining on
the screen. Participants were asked to move the dot by moving the pen on the digitizer as
quickly and accurately as possible upward (downward) when the word was a noun (adjective),

or vice versa. When the dot met the border of the upper or lower rectangle bar the word disappeared and the next trial started. A red cross appeared for 400 ms in case of an incorrect response, and "te laat" (too late) appeared when no response was given after 3000 ms. The time between the appearance of the word and the moment when the starting point was left (with pen pressure exceeding 0.24 N) served as the dependent variable. Each participant completed two blocks, one with the response mapping noun-upward and adjective-downward, and one with the reversed mapping. The order of the blocks was counterbalanced across participants. Each block consisted of 128 trials presented in random order and was preceded by 20 practice trials.

Results

Study 2a. Incorrect responses (8.5%) and latencies below 150 ms and above 1500 ms (9.1% of the correct responses) were discarded. A 2 (evaluative compatibility) X 2 (motivational compatibility) ANOVA yielded the expected motivational compatibility effect (i.e., faster when approaching positive and avoiding negative words), $F(1,93) = 7.56$, $p = .007$, $|^2 = .08$ (Table 1). Neither the main effect of evaluative compatibility effect, $F < 1$, nor the interaction was significant, $F < 1.6$.

Study 2b. Incorrect responses (0.15%) as well as latencies below 150 ms and above 1500 ms (0.89% of the correct responses) were discarded. A 2 (evaluative compatibility) X 2 (motivational compatibility) ANOVA showed the expected effect of motivational compatibility, $F(1,33) = 12.25$, $p = .001$, $|^2 = .27$ (Table 1). Neither the main effect of evaluative compatibility nor the interaction was significant, all Fs < 1.

General Discussion

The results of three studies support the motivational view of approach-avoidance behaviors. Responses to valenced stimuli were faster when they implied a compatible distance-change (i.e., positive-toward, negative-away) than when they implied an

incompatible distance-change (i.e., positive-away, negative-toward). Most importantly, this effect occurred even though participants did not intend to approach or avoid but mentally represented their behaviors as up and down movements, with up and down movements being independent of actual distance-change. Thus, approach-avoidance behaviors were facilitated although the valence of the response labels was dissociated from the approach-avoidance direction. This finding is at odds with the evaluative coding account of approach-avoidance behaviors (Eder & Rothermund, 2008; Lavender & Hommel, 2007), which suggests that response facilitation is only due to (in)compatibility of stimulus valence and response label valence. We observed effects of stimulus valence on unintended approach-avoidance responses when participants had evaluation intentions (Study 1) as well as in the absence of evaluation intentions (Study 2). While in Study 1 the motivational compatibility effect was only significant in the evaluative compatible block, in Study 2 it occurred independent of evaluative compatibility. This supports our reasoning that the interaction between evaluative and motivational compatibility in Study 1 was due the block structure of the task. Corroborating the generality of the findings, these results were obtained with two different response modes, namely moving a figure by pressing a key (Study 2a) and moving a dot by moving a pen (Study 2b). Together, the present findings corroborate the assumption of a unique automatic link between stimulus valence and motivational orientations that cannot be reduced to a more general mechanism of action control such as the one described by the TEC (Hommel et al., 2001).

Importantly, in Study 1 we also observed effects of stimulus valence on intended upward-downward responses, thereby replicating the results of Eder and Rothermund (2008). In particular, responses in compatible trials (positive-upward, negative-downward) were faster than responses in incompatible trials (positive-downward, negative-upward). However, this evaluative compatibility effect depended on participants' intention to process stimulus valence, as it did not occur when they responded according to the grammatical category

(Studies 2a and 2b). This observation is consistent with previous findings in the framework of the evaluative coding account (Lavender & Hommel, 2007).

We suspect that previous research did not reveal motivational compatibility effects independent of response labeling because the responses were ambiguous regarding their distance-changing consequences. In particular, pushing and pulling a joystick like in Eder and Rothermund's (2008) studies can either mean pushing the stimulus away from the body and pulling it toward the body, or reaching for the stimulus and withdrawing the hand from it (Seibt et al., 2008). In Lavender and Hommel's (2007) study, participants moved a doll from a plate positioned in front of the computer screen to a plate nearer to the screen (but farther away from the participant) or to a plate farther away from the screen (but nearer to the participant). Motivational compatibility effects can only be tested when participants perceive the movement as changing the distance between the doll and the stimulus. However, it is possible that they perceive the movement mainly as changing the distance between their body and the doll. The possibility of focusing on different distance-changes introduces error variance, thereby decreasing the power of the test to detect effects of unintentional valence processing (cf. Krieglmeyer & Deutsch, in press). In contrast, the responses in the manikin and the pen-moving task are unambiguous regarding distance-change. In both tasks, the change of the distance between the stimulus and the manikin or the dot can be clearly seen on the screen. Furthermore, the distance of all stimuli to the participants' body remains constant, excluding the possibility that participants focus on distance-changes relative to their body.

Another advantage of our adapted manikin task is that it allows excluding the alternative explanation that participants re-labeled the responses in terms of approach-avoidance movements. Re-labeling is likely to occur if it reduces the complexity of the task (cf. Eder & Rothermund, 2008). In our task, re-labeling the responses in terms of toward-away would rather increase task complexity. Using the instructed labels implies a very simple rule: positive - upward, negative - downward. Re-labeling the behaviors in terms of distance-

change would yield a more complex rule, for instance "If the word is positive and the figure appears above the word, then move away by pressing the up key".

In sum, our findings indicate that two mechanisms may proceed in parallel when one encounters emotionally significant stimuli. As suggested by the evaluative coding view, evaluation intentions may modulate to what degree stimulus valence activates responses that are labeled in an affectively compatible way. For instance, if we were about to decide between being aggressive (negatively labeled action) or diplomatic (positively labeled action), encountering something negative might facilitate the first action. The motivational mechanism may operate independent from and in parallel to the evaluative coding mechanism. In particular, stimulus valence elicits motivational orientations, resulting in the activation of behavioral tendencies that increase or decrease the distance between the self and the stimulus. This mechanism operates independent of evaluative response labeling as well as independent of behavioral and evaluation intentions, thereby automatically fulfilling important regulatory needs of organisms (cf. Lang et al., 1990). For instance, when a car speeds toward us, this mechanism would let us quickly jump away, irrespective of what we are intending at this moment and irrespective of how we label our response. Importantly, this mechanism does not inflexibly activate concrete motor programs such as flexing or extending the arm (e.g., Cacioppo, Priester, & Berntson, 1993). Instead, it activates behavioral tendencies that have adaptive consequences in the given context. In other words, approach-avoidance behaviors are conceived of as being represented in terms of their distance-changing consequences rather than in terms of their motor programs (Strack & Deutsch, 2004; van Dantzig, Pecher, & Zwaan, 2008). In essence, our findings corroborate the idea of a distinct motivational mechanism that efficiently processes emotional stimuli and quickly triggers functional responses.

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Acknowledgments

Footnotes

[1] We conducted preliminary analyses that included the counterbalancing factors *order of blocks* (Study 1) and *mapping of grammatical categories and upward-downward responses* (Study 2). In Study 1, the interaction between order of blocks and evaluative compatibility was significant, $F(1,45) = 6.51$, $p = .014$. The evaluative compatibility effect was positive in both order groups. Yet, it reached significance only when participants first completed the evaluation incompatible block, $t(45) = 4.68$, $p < .001$, but not in the reverse order, $t(45) = 1.13$, $p = .26$. In Study 2a, the main effect or interactions with the counterbalancing factor were not significant, all Fs < 1.7. In Study 2b, the main effect of mapping of grammatical categories, $F(1,33) = 4.47$, $p = .042$, and the interaction between mapping and evaluative compatibility reached significance, $F(1,33) = 4.38$, $p = .044$. Yet, the evaluative compatibility effect was not significant in any of the mapping conditions, ts < 1.7, $p > .10$.

[2] This cutoff was chosen based on the distribution of the response latencies as well as based on previous research that compared different criteria for outlier elimination in the manikin task (Krieglmeyer & Deutsch, in press).

Table 1

Mean Response Latencies (in ms) as a Function of Evaluative Compatibility and Motivational Compatibility in Studies 1 and 2.

	Evaluative Compatible		Evaluative Incompatible	
	Motivational Compatible	Motivational Incompatible	Motivational Compatible	Motivational Incompatible
Study 1	747 (107)	781 (119)	820 (146)	825 (147)
Study 2a	888 (129)	909 (140)	893 (126)	900 (138)
Study 2b	629 (93)	638 (88)	630 (93)	639 (97)

Note. Standard deviations are printed in parentheses.

Figure Captions

Figure 1. Illustration of the experimental variations.

Figure 1