Individual Differences in Approach and Avoidance Movements: How the Avoidance Motive Influences Response Force

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ABSTRACT The present research is based on the assumption that people differ in their responsiveness to incentives and threats. In two experiments we examined whether the trait corresponding to the responsiveness to threats (avoidance motive) and the trait corresponding to the responsiveness to incentives (approach motive) influence voluntary motor behavior toward or away from stimuli. In Experiment 1, stimuli consisted of positive and negative words within a lexical decision task. Participants moved their arms backward in order to withdraw from the stimuli or forward in order to approach them. In Experiment 2, participants responded with forward or backward arm movements to neutral sounds coming from behind or in front of them.

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The main dependent variable was the strength of the approach and avoidance movements. In both experiments this variable was related to participants’ avoidance-motive disposition but not to their approach-motive disposition. Avoidance-motivated individuals generally showed more forceful avoidance movements than approach movements. There was no effect of stimulus valence on the strength of the movements in Experiment 1. Furthermore, the results of Experiment 2 suggest that it is not the physical direction (forward or backward) but rather the movement’s effect of distance reduction (approach) or distance increase (avoidance) in regard to the stimulus that defines a movement as an approach or an avoidance movement.

A basic dimension of human and animal behavior is its direction. Following the hedonic principle, human beings and animals are motivated to approach pleasant objects and to avoid or to withdraw from unpleasant ones. There is a broad consensus that this behavior is directed by two opponent motivational systems: an appetitive and an aversive one (Carver, Sutton, & Scheier, 2000; Gray, 1982; Lang, Bradley, & Cuthbert, 1997; Lewin, 1936). These systems are assumed to build an interface between perception and behavior (Bargh, 1997). They are thought to be activated automatically by incoming stimuli and to evoke a set of approach or avoidance behavioral tendencies, as well as positive or negative emotions. Elliot and Thrash (2002) pointed out that the approach–avoidance distinction also pertains to some basic dimensions of personality. These basic dimensions are neuroticism and extraversion (Eysenck & Eysenck, 1985), positive and negative emotionality (Tellegen, 1985; Watson & Clark, 1993), and, finally, the sensitivity of the behavior activation system (BAS) and that of the behavior inhibition system (BIS) (Gray, 1982). By means of explanatory and confirmatory factor analyses, Elliot and Thrash (2002) showed that, on the one hand, extraversion, positive affectivity, and BAS-sensitivity were strongly interrelated. On the other hand, there was a close relationship between Neuroticism, negative affectivity, and BIS-sensitivity. The authors proposed to interpret the shared variance among the different personality constructs in terms of approach and avoidance motivation and labeled the core constructs approach temperament and avoidance temperament. These temperaments are thought to determine whether people are more responsive to incentives or to threats. In the following, we will call these temperaments motives because the
definition provided by Elliot and Thrash (2002) is reminiscent of McDougall’s *instinct* definition, from which modern concepts of motive dispositions are derived (McDougall, 1908; see also McClelland, 1985; Schneider & Schmalt, 2000). According to these concepts, motives are seen as individual dispositions that automatically direct attention toward relevant stimuli and give rise to corresponding emotional excitement and goal-directed activities toward or away from relevant objects.

In the last two decades, numerous researchers have distinguished between implicit and explicit motives (e.g., Brunstein, Schultheiss, & Grässmann, 1998; McClelland, Koestner, & Weinberger, 1989; Woike, Mcleod, & Goggin, 2003). The motive definition presented above fits the concept of implicit motives best. Implicit motives are seen as dispositions, which are not necessarily consciously represented. Therefore, they can be assessed through projective techniques like the Thematic Apperception Test (TAT; Murray, 1943). Implicit motives are associated with emotional experiences and with spontaneous expressive behavior and are most likely to emerge in unstructured or ambiguous situations. In contrast, explicit motives, which can be assessed with questionnaires, reflect what people think or say about their goals, wishes and duties.

Schmalt (1976, 1999) developed a semiprojective instrument that can be used to assess the approach and avoidance components of implicit motives (for a discussion see Kehr, 2004). Recently, Sokolowski, Schmalt, Langens, and Puca (2000) published a multimotive version of this technique in order to measure the approach and avoidance components of the achievement, power, and affiliation motives. Gable, Reis, and Elliot (2003) showed that the fear and the hope scales of the Multi-Motive Grid (MMG) loaded significantly high on the appropriate latent variables in a two-factor model with one approach and one avoidance factor.

There is evidence, stemming not only from scale analyses but also from physiological data, suggesting that global approach and avoidance dispositions exist. EEG studies show that the left anterior cortex is linked to the approach motivational system and the right anterior cortex is linked to the avoidance motivational system. Tomarken, Davidson, Wheeler, and Doss (1992) showed that people chronically high in relative left anterior activation reported higher generalized positive emotionality and lower generalized negative emotionality than did people chronically high in right anterior activation. Sutton
and Davidson (1997) found that people with left frontal EEG asymmetry at rest revealed higher BAS scores, whereas people with right asymmetry had higher BIS scores.

In sum, the approach and avoidance motivational systems seem to be dispositionally preactivated. We call this preactivation an approach motive and an avoidance motive, respectively. Motives can be interpreted as traits, which are supposed to determine whether people’s attention is directed predominantly at aversive or at appetitive situations. In addition, they are thought to influence emotions and behavioral tendencies.

**Reaction Time and Response Force as Different Indicators of Motor Processes**

In the motive definition mentioned above, it was stated that motives instigate goal-directed behavior toward or away from relevant objects. Likewise, Elliot and Thrash (2002, p. 805) theorized that approach and avoidance temperaments are accompanied by a behavioral predisposition to approach such relevant objects and to withdraw from them, respectively. To date, no research directly testing whether a global approach or avoidance disposition does actually affect approach and avoidance motor responses has been reported. It is the aim of the present experiments to close this gap. To investigate the link between personality and motor behavior, we introduce response force (RF) together with reaction time (RT) as a main dependent variable. RT is the most common measure to scrutinize the information processes taking place between stimulus presentation and an overt response. It reflects the total duration of information processing and covers processes like stimulus identification, decision making, and motor preparation. On the basis of RT measures, however, one can only get indirect evidence for the effects of experimental variables on the duration of these subprocesses. Furthermore, the inferences drawn from RT measures strongly depend on the assumption of the employed models about the architecture of the information processes (McClelland, 1979; Rinkenauer, Osman, Ulrich, Müller-Gethmann, & Mattes, 2004; Sanders, 1998; Sternberg, 1969). Thus, if individual differences in RT occur, one cannot directly conclude that people differ in their motor behavior. The differences may also be due to differences in the duration of
some processes preceding the motor processes (e.g., sensory or decision processes; Sanders, 1998).

In contrast, RF has been recognized as a more direct indicator for motor activation and thus can supply the experimenter with information about whether and by which variables the motor system has been influenced in the particular experimental task. Cognitive psychologists have introduced this variable in information-processing research to distinguish better between experimental effects on motor and nonmotor processes (Mattes, Ulrich, & Miller, 1997; Ulrich, Mattes, & Miller, 1999; Ulrich, Rinkenauer, & Miller, 1998). There is much evidence that RF is a measure of different aspects of information processing than RT (e.g., Giray & Ulrich, 1993; Jaskowski, Rybarczyk, Jaroszyk, & Lemanski, 1995; Miller, Franz, & Ulrich, 1999). The additional information obtained from RF was utilized, for example, to investigate the influence of stimulus information on motor processes (e.g., Jaskowski et al., 1995; Ulrich et al., 1998) or to assess motor effects in the context of attention (Giray & Ulrich, 1993) and memory research (e.g., Abrams & Balota, 1991).

There are two ways of measuring response force. Peak force (PF) is the most common index of RF. It reflects the strength of the response. PF is obtained by recording the force from the onset of isometric force production or movements until their offset. The force-time functions of simple movements like pressing a button are bell shaped and almost symmetrical. This means that the force curve rises to a maximum, called peak force, and then declines to zero (see Giray & Ulrich, 1993). Another way to assess RF is to record the movement time (MT), which is the interval from response onset until response offset. For example, if participants are instructed to move their hand from a starting point to a target at a certain distance, MT is inversely proportional to the driving muscle force necessary to perform the movements (Schmidt, Sherwood, Zelaznik, & Leikind, 1985; Schmidt, Zelaznik, Hawkins, Frank, & Quinn, 1979). Briefly, the shorter MT of such aiming movements, the higher the underlying RF.

The strength of motor responses is of particular interest for studying goal-directed behavior because it is essential for regulating the distance between individuals and desired or undesired objects. The more force animals or people produce, the nearer and faster they can approach desired objects. Similarly, more force allows one to move faster and further away from undesired objects. It is surprising, then, that RF has not yet become a common measure in the research area of
motivation and goal-directed behavior. To our knowledge, there is only one study that has investigated the force, and thus the intensity, of approach and avoidance movements. Brown (1948) placed rats in a runway with food at the end. With a special harness he measured the amount of pull the animals exerted toward the food. He found that the strength of the approach movements depended on whether the rats were food deprived or not (i.e., on the strength of their approach motivation). Hungry rats pulled more strongly toward the food than rats that were not food deprived.

To summarize, we think that borrowing from cognitive psychology may help us investigate the influence of approach and avoidance dispositions on motor processes. Thus, we propose to introduce RF as an additional dependent variable in the research on human motivation. Assessing this variable may help to get a more complete picture of approach and avoidance motor behavior.

**Research in Approach and Avoidance Motor Behavior**

Even though RF has rarely been used to investigate voluntary approach or avoidance movements, it plays an important role in studies investigating individual differences in the modulation of the startle reflex. Startle reflexes are short involuntary flexor contractions elicited by abrupt, intense stimuli (e.g., loud noise). The two important parameters of the startle reflex are the latency and the amplitude of the muscle contraction. The amplitude can be seen as the equivalent for peak force. A typical finding is that pleasant and unpleasant foreground stimuli can modulate the startle reflex. Unpleasant stimuli increase the amplitude of the startle responses to loud acoustic stimuli, whereas pleasant stimuli attenuate it. Lang and colleagues (1990) assumed that unpleasant stimuli activate the avoidance motivational system, which also prompts defensive reactions like the startle reflex (see Kumari et al., 1996; Vrana, Spence, & Lang, 1988). It has repeatedly been found that personality traits influence the two startle-response measures in a different way (e.g., Corr et al., 1995). Furthermore, it has been argued that different processes are reflected by the two startle-response measures. Some researchers contend that startle modulation is due to preattentive sensory processes, whereas others presume that motor processes may be responsible for these effects (cf. Corr et al., 1995; Kumari et al., 1996; Lang et al., 1997). Thus, individual differences in startle
modulation may result from individual differences in sensory processes, from individual differences in motor processes, or from both.

In sum, there is evidence from research on the modulated startle reflex that personality traits influence the motor system. The main restriction of this paradigm is, however, that only reflexes and only avoidance motor behavior can be investigated. The intention of our study was to investigate voluntary behavior rather than reflexes. We therefore decided to adopt an experimental paradigm from social cognition. Voluntary approach and avoidance movements have frequently been investigated in this field.

Chen and Bargh (1999) hypothesized that evaluative information initiates directive forces affecting motor behavior. In this research, RT was the main dependent variable. The authors reported that RT was reduced for positive stimuli when participants had to perform approach movements and for negative stimuli when they had to perform avoidance movements. In contrast, RT was prolonged in the positive-avoidance and negative-approach conditions. Wentura, Rothermund, and Bak (2000) hypothesized that words like aggressive and friendly, which signal a potentially dangerous or potentially safe social environment, were linked to avoidance and approach motor behavior, respectively. Further, Wentura and his colleagues predicted that RT would decrease if the behavioral tendency evoked by the words matched the type of response required in the particular experimental condition. When a word appeared on the computer screen, participants either had to press a key positioned in front of the screen (approach) or release the key and withdraw from it (avoidance). In the withdraw group, the stimulus size grew smaller after this response, and in the press group, it grew bigger. With this procedure the authors wanted to simulate an increase and a decrease of distance between the participant and the stimulus, respectively. As predicted, RT was reduced for negative words in the withdraw group and for positive words in the press group.

Overview of the Present Studies: Individual Differences in Approach and Avoidance Motives and Response Force

Drawing on studies in which the sensitivity of the appetitive and the aversive motivational systems is seen as a trait, we assume that these systems can be dispositionally preactivated to a certain degree. Because of this preactivation, people may be more or less motivated to
show approach or avoidance movements even when valenced stimuli are absent. We expect that people produce more forceful movements when the required movement corresponds to their motive dispositions than when it doesn’t correspond. In the following we will call this hypothesis the “motive-movement congruency.”

To determine whether motor responses are actually affected by people’s motive dispositions, we extended the above-mentioned paradigm used by Wentura et al. (2000) by introducing RF as a supplementary dependent variable. Wentura et al. (2000) combined backward movements with a visual illusion of withdrawal and forward movements with a visual illusion of approach by altering stimulus size after the response. In contrast, we decided to keep the size of the presented stimuli constant. Ulrich et al. (1998) showed that the physical properties of the stimulus affect response force even after response onset. Changes in stimulus size mutually produce changes in stimulus intensity. Thus, they may bias the response force and blur the effects of the stimulus content and the avoidance motive on it.

In our first experiment, we used peak force as the main dependent variable and introduced movement direction as a between-subject factor. The second experiment was conducted to test whether the motive-movement congruency can also be shown within groups. If avoidance-motivated individuals prefer avoidance movements, they should show not only stronger avoidance movements than approach-motivated individuals but also stronger avoidance than approach movements. The dependent variable in the experiment was movement time. We introduced this variable to show that the motive effect on RF does not depend on how RF is assessed.

**EXPERIMENT 1**

The main purpose of our study was to test the motive-movement congruency hypothesis. In a second step, we additionally wanted to test whether the congruency effect on RF depends on the valence of the stimuli. For instance, high avoidance-motivated individuals were expected to be more motivated to display avoidance responses than to perform approach responses. This motive-movement congruency effect should be more pronounced for negative than for positive stimuli because the movement should be enhanced by both the motive disposition and the negative valence of the incoming
stimulus. If Wentura et al.’s (2000) findings (RT for avoidance responses was shorter following negative stimuli than following positive stimuli) had been due to the fact that the valence of the stimuli instigated motor behavior, we should also find stronger stimulus-congruent responses than stimulus-incongruent responses. With the modified paradigm, it should be possible to test motive-stimulus congruency effects as well as stimulus-movement congruency effects.

METHOD

Participants

The initial sample consisted of 59 participants. Three of them were excluded from data analysis because of missing data. In addition, three participants were excluded because their overall RF was more than 2 standard deviations above the mean. There were no outliers for RT. Of the remaining 53 participants, 38 were female. The age ranged from 16 to 48 years ($M = 25.47$, $SD = 6.54$). All participants were German native speakers, and 36 were students. They received DM 15 (about $7 at the time) for their participation.

Procedure

A male or a female experimenter tested participants individually. They were first asked to complete the Multi-Motive Grid (MMG), with which the implicit approach and avoidance motive dispositions were assessed (see Sokolowski et al., 2000).

After completing the MMG, participants had to work on a lexical decision task. The experiment was run in a normally illuminated room. Participants were comfortably seated at a distance of approximately 75 cm in front of a high-resolution color screen. Positive, negative, and neutral words and nonwords were presented in the center of the screen (yellow on a blue background). The letters were 17.5 mm high and 4 to 12 mm wide. Before the presentation of the positive and negative words, a block of neutral words was presented. Positive and negative words, as well as neutral words, were mixed with nonwords and presented in a random order. At the beginning of each trial, a fixation cross that served as a warning signal appeared in the center of the screen. After 500 ms, the fixation cross was replaced by a word or a nonword. In one group, participants had to move their forearm toward the screen (approach) whenever a word appeared, whereas in the other group, they had to withdraw the forearm from the screen (avoidance) when a word appeared. The
stimuli disappeared 250 ms after the response, or 1000 ms after onset, if no response occurred. The stimuli were not immediately erased after response onset because we wanted to avoid the possibility that the participants in the approach condition would get the impression of pushing the words away and thus interpret the movement as avoidance. Participants were required to respond as correctly and as quickly as possible. They were randomly assigned to either the approach- or the withdrawal-movement condition. At the end of the experiment, participants were debriefed.

Materials and Apparatus

Apparatus. Participants were asked to respond with their dominant hand. The responding forearm rested on a movable platform and the hand lay flat on this platform with the palm showing downwards. The forearm was positioned in a fixture, which had the form of a half-pipe, and was fixed with a Velcro fastening band. The height of the platform was individually adjusted so that the participants could comfortably move their forearms toward the screen and away from it, respectively. The platform was attached to a force transducer by the means of springs. The distance between the participant’s hand and the screen was 33 cm at the baseline position. After the response, the movable plate automatically returned to that baseline position with the help of the springs.

Backward or forward movements of the platform stretched the respective spring, and thus the force acting between the platform and the force transducer increased. The resistance of the platform increased linearly with increasing distance from the resting point. The moving range of the platform was from 10 cm forward to 10 cm backward and the force ranged from 500 cN at the zero position to 2500 cN at the points of maximum deflection. The output signal of the force transducer was amplified with a custom-designed device, and the amplified signal was digitized with a sampling frequency of 100 Hz.

Approach and avoidance motives. The motive dispositions were assessed with the short form of the MMG (MMG-S; see Sokolowski et al., 2000). The MMG is based on a semiprojective technique developed by Schmalt (1976, 1999). The grid technique is a procedure that combines the features of projective techniques such as the TAT and those of questionnaires. The MMG measures the approach and avoidance components of the achievement, power, and affiliation motives. For the present experiment, we computed one approach and one avoidance score by summing up the respective item scores of the three motives. Cronbach’s alpha was
\( z = .79 \) for the avoidance scale and \( z = .85 \) for the approach scale in the present sample.

**Test materials.** The test materials were the same as in the study of Wentura et al. (2000) with the exception of the neutral words (see below for our reasoning concerning the choice of differing neutral words). The stimuli consisted of 125 words. Fifty of the adjectives were positive, 50 were negative, and 25 were neutral. Wentura and his colleagues had selected this material on the basis of its pleasantness value according to a norm list of common German adjectives (see Möller & Hager, 1991). The different word categories were closely parallel regarding parameters like frequency, mean length, or imageability. Besides the 125 words, we also used 125 pronounceable nonwords. The nonwords were parallel to the words in their mean length (for details see Wentura et al., 2000).

In contrast to Wentura and his colleagues, we used neutral words that were not personality traits. We did this because, in a pilot study, we had found evidence that the evaluation of neutral personality adjectives may be biased by peoples’ avoidance motives. In a first pilot study, 35 participants had had to rate the personality adjectives on a scale ranging from \(-5\) (very negative) to \(+5\) (very positive). The mean for the neutral personality adjectives had been near zero \((M = .24, SD = .62)\). There had been, however, a significant negative correlation between participants’ avoidance motives and their ratings for these adjectives \((r = -.39, p < .05)\). The higher the avoidance motive, the more negative participants had rated the neutral adjectives. Thus, the control words seemed not to be completely neutral for all participants. In a second pilot study, 35 participants had had to rate 25 neutral words, which were common adjectives like “diagonal” or “ultraviolet” but which did not represent personality traits. Again, the mean rating for the neutral words was virtually zero \((M = .05, SD = .24)\), indicating that the mean rating had been neither positive nor negative. In contrast to the first pilot study, there was no correlation between the participants’ avoidance motive and the rating \((r = -.07, ns)\). This set of neutral words was therefore used in the present experiment. Like the neutral words in the study of Wentura et al. (2000), the new neutral words closely paralleled the valenced ones and the nonwords regarding word length.

Another difference to the study of Wentura and his colleagues was that in the current experiment neutral words were not mixed with positive and negative ones. It may be that valent stimuli induce an enduring motivational state and thus influence the RF even for subsequent neutral stimuli. To make sure that no valenced words could activate the approach or avoidance systems during the testing period of the
neutral words, the neutral words were presented in a block before the valenced ones. In this first block, the 25 neutral words were mixed with 25 nonwords.

Results

Preliminary Analyses and Descriptive Statistics

Preliminary analyses examined the effects of gender. Participants’ gender had no significant impact on the results, and thus data were collapsed across gender in subsequent analyses. In a pilot study we had found that the avoidance, but not the approach, motive had an impact on motor behavior (Breidenstein, Puca, & Rinkenauer, 2003). A preliminary data analysis showed that this was also the case for the present data. Therefore, only analyses with the avoidance motive will be presented.

Data Analysis Strategy

All analyses are based on multiple regression, including movement direction, the avoidance score, and their cross-product as independent variables. The means, standard deviations, and intercorrelations of the variables used in the analyses are presented in Table 1.

As suggested by Friedrich (1982, cited in Aiken & West, 1991), we first calculated the $z$-scores for the first two predictors and the respective dependent variable. Then, we formed the cross-product of the standardized predictors. With this procedure it was possible to interpret the unstandardized solution of the analyses as standardized regression coefficients (betas).

First, we tested the hypothesis that participants produce more force when they have to perform motive-congruent movements as compared to incongruent movements. That means that participants with high avoidance scores were assumed to perform more forceful movements when they have to withdraw from the stimuli than when they have to approach them. In addition to this two-way interaction, we analyzed the three-way interaction by using the difference between the RF for positive and negative words as the dependent variable. With this analysis we tested whether the congruency effect depends on the valence of the presented stimuli. If the congruency effect is independent of the stimulus valence, the motive-movement
<table>
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<tr>
<th>Measure</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>M</th>
<th>SD</th>
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<tr>
<td>1. Avoidance Score</td>
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<td>5.66</td>
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<tr>
<td>2. PF Negative Words</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1718</td>
<td>439</td>
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<td>3. PF Positive Words</td>
<td>.24</td>
<td>.99**</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>1725</td>
<td>436</td>
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<tr>
<td>4. PF Neutral Words</td>
<td>.21</td>
<td>.92**</td>
<td>.92**</td>
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<td></td>
<td>1732</td>
<td>366</td>
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<td>5. PF (Pos. + Neg. Words)/2</td>
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<td>1721</td>
<td>437</td>
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<td>6. PF Pos.–Neg. Words</td>
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<td>-.12</td>
<td>-.03</td>
<td>-.10</td>
<td>-.08</td>
<td></td>
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<td>6</td>
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<td>7. RT Negative Words</td>
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<td>-.12</td>
<td>-.10</td>
<td>-.20</td>
<td>-.11</td>
<td>.15</td>
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<td>8. RT Positive Words</td>
<td>-.15</td>
<td>-.07</td>
<td>-.06</td>
<td>-.16</td>
<td>-.06</td>
<td>.08</td>
<td>.94**</td>
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<td>-.13</td>
<td>-.11</td>
<td>-.25</td>
<td>-.12</td>
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<td>.82**</td>
<td>.78**</td>
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<td>10. RT (Pos. + Neg. Words)/2</td>
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<td>.12</td>
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<td>11. RT Pos.–Neg. Words</td>
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<td>.12</td>
<td>.10</td>
<td>.08</td>
<td>.11</td>
<td>-.18</td>
<td>.03</td>
<td>.37**</td>
<td>.11</td>
<td>.21</td>
<td>17</td>
<td>19</td>
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*Note. PF = Peak Force (in cN), RT = Reaction Time (in ms), N = 53, **p < .01.*
interaction should also be found in the analysis of the neutral words. For exploratory purposes, the same analyses were conducted for the RT measures.

**Peak Force**

In the present experiment, RF was defined as the maximum force produced in a single trial. As usual in research on motor behavior, we call this variable *peak force* (PF). In the first analysis, the mean PF of all positive and negative words was regressed on movement direction, avoidance motive, and their cross-product. To avoid the influence of large isolated errors, the two medians of the PF for the 50 positive words and for the 50 negative words were calculated. The dependent variable was the mean of these two medians. The analysis indicated that PF could be predicted by the required movement direction and by the interaction of the movement direction and participants’ avoidance motive (see Table 2). Participants showed more forceful movements in the withdrawal group ($M = 1954\, \text{cN}, SD = 500$) than in the approach group ($M = 1529\, \text{cN}, SD = 255$). The nature of the interaction is depicted in Figure 1. Participants high in dispositional avoidance motivation performed stronger movements in the withdrawal group than in the approach group. This difference was markedly reduced for participants who were low in their dispositional avoidance motivation.

In the second analysis, a three-way interaction between motive disposition, movement direction, and word valence was tested. Therefore, the difference of the PF medians of positive and negative words

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>$SE$</th>
<th>$t$</th>
<th>$p$</th>
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<tr>
<td>Avoidance Motive</td>
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<td>.76</td>
<td>.45</td>
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<tr>
<td>Movement Direction</td>
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<td>.117</td>
<td>-4.02</td>
<td>.001</td>
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<tr>
<td>Avoidance $\times$ Movement Direction</td>
<td>-.28</td>
<td>.120</td>
<td>-2.37</td>
<td>.02</td>
</tr>
</tbody>
</table>

*Note. $R^2 = .34 \,(N = 53, \, p < .001)$.*
was regressed on the same predictors as in the preceding analyses. This analysis yielded no significant effects ($\beta = .03$, $t = .09$, ns).\(^1\)

In the third analysis, PF for the neutral block of words was regressed on movement direction, avoidance motive, and their cross-product. The results were the same as in the first analysis. There was a significant effect for movement direction ($\beta = .48$, $t = 4.13$, $p < .001$) and a significant interaction between movement direction and participants’ avoidance motive ($\beta = .27$, $t = -2.26$, $p < .03$). The nature of the interaction was the same as for the valenced words.

**Reaction Time**

In the following analyses, RT for the different word categories was regressed on the same predictors as in the PF analyses. The regression of the mean RT for all positive and negative words on the

---

\(^1\) Wentura et al. (2000) have made a distinction between self- and other beneficial words. Like the valence of the words, this distinction did not have any effects in the present experiments.
dictors yielded no significant effects. Just as for the valenced words, the analysis for the neutral words yielded no significant effects.

In contrast to the PF analyses, there was a significant interaction when the difference between RT for positive and for negative words was regressed on the predictors (see Table 3). This interaction is depicted in Figure 2. The negative means indicate that RT was always

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>$SE$</th>
<th>$t$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance Motive</td>
<td>- .18</td>
<td>.143</td>
<td>- 1.27</td>
<td>.21</td>
</tr>
<tr>
<td>Movement Direction</td>
<td>- .02</td>
<td>.137</td>
<td>- .12</td>
<td>.91</td>
</tr>
<tr>
<td>Avoidance × Movement Direction</td>
<td>- .31</td>
<td>.140</td>
<td>- 2.19</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. $R^2 = .10$ ($N = 53$, ns).

![Figure 2](image)

**Figure 2**

Experiment 1: Mean difference in reaction time (RT) between positive and negative words (positive minus negative) as a function of movement direction (approach vs. withdrawal) and motive disposition computed for values 1 SD below (low) and 1 SD above (high) the mean of the avoidance score. Negative differences indicate that RT is longer for negative than for positive words.
longer for negative than for positive words. This positive-word advantage was, however, moderated by participants’ avoidance motive and the required movement direction. This advantage was reduced when high avoidance-motivated individuals had to withdraw from the words as compared to the approach condition. For low avoidance-motivated individuals it was vice versa.

**Discussion**

Analyses of PF revealed the predicted interaction between motive and movement direction. High avoidance-motivated individuals showed stronger movements in the withdrawal group than in the approach group. That means that high avoidance-motivated individuals showed stronger responses when the required movement was congruent with their motive disposition than when it was not. The motive-movement interaction was found for valenced personality adjectives, as well as for neutral words, which were not personality related. Thus, it cannot be argued that high avoidance-motivated individuals may just be less prone to approach other people than low avoidance-motivated individuals.

Contrary to our predictions, low avoidance-motivated individuals also showed somewhat stronger movements when withdrawing from the words than when approaching them. This difference was, however, much smaller than for participants with high avoidance motivation. The experimental setting may have caused the main effect of movement direction. Participants who had to move their arm toward the stimuli may have experienced the computer screen as a barrier. Thus, the forward movements may have been more restricted than the backward movements and may have caused the participants in the forward group to produce less force.

We have hypothesized that the motive-movement congruency effect should be moderated by the valence of the incoming stimuli. In contrast to this prediction, we could not find a three-way interaction between motives, movement direction, and word type. Surprisingly, there was no influence of the word type on PF at all. PF was very similar for all word categories (i.e., the intraindividual variance in PF was low). This could be due to the mechanical characteristics of our apparatus. The minimum force required to move the plate was approximately 500 cN. In addition to the inertia of the moving platform, this force threshold may have reduced the intraindividual variability in PF.
Analyses of RT revealed no interaction between avoidance motive and movement direction on the mean of positive and negative words. Thus, high avoidance-motivated individuals, who generally produced more force when withdrawing from the words than low avoidance-motivated individuals, did not initiate the motive congruent movements more quickly. The Motive × Movement Interaction was, however, significant when the difference of positive and negative words was used as dependent variable. As mentioned above, this difference was generally negative (i.e., RT was longer for negative than for positive words). This positive-word advantage was shown for both movement conditions and for both high avoidance-motivated and low avoidance-motivated individuals. The difference between RT for positive and for negative words in lexical decision tasks is a common finding, which may be interpreted as an attentional bias toward negative stimuli. Negative stimuli are thought to capture more attention than positive ones. As a consequence, in lexical decision tasks, the decision whether the presented string is a word takes longer for negative than for positive words (e.g., Wentura et al., 2000).

In the present experiment, the positive-word advantage was somewhat reduced when high avoidance-motivated individuals had to withdraw from the stimuli and when low avoidance-motivated individuals had to approach them. This finding might be interpreted as a kind of congruency effect: High avoidance-motivated individuals responded slightly faster to negative words when they had to withdraw. With the present paradigm, however, it is difficult to determine whether the congruency among word valence, avoidance motive, and movement direction influences stimulus detection, the decision process, or motor preparation. As mentioned above, RT is a compound of the time needed for all processes between stimulus presentation and response onset. This was the reason why we had no specific hypothesis for RT in the present experiment.

Taken as a whole, Experiment 1 provided initial support for our hypothesis that movements are more forceful when the required movement direction corresponds to the participants’ avoidance-motive disposition than when it doesn’t correspond. For several reasons, however, we needed additional empirical data to support this hypothesis. First, contrary to our predictions, not only high avoidance-motivated participants showed stronger movements in the withdrawal than in the approach group. The withdrawal group performed stronger movements than the approach group even when
the participants scored low on the avoidance scale. Second, we used a between-subject design, which makes it difficult to draw conclusions about intraindividual movement preferences. Third, we defined backward movements as avoidance and forward movements as approach. The problem with this definition is that backward and forward movements, respectively, are not unequivocally associated with approach and avoidance, respectively. In a study by Chen and Bargh (1999), participants had to move their arm backward to pull a lever toward them (approach) or to move their arm forward to push the lever away (avoidance). Thus, backward movements may also be associated with approach and forward movements may be associated with avoidance. Recently, Markman and Brendl (2005) showed that, depending on participants’ representation of themselves in space, both forward and backward movements could represent approach or avoidance movements. Participants in their study had to push or pull a lever in response to negative or positive words. These words appeared on a computer screen in a corridor either in front of or behind the participants’ names. Participants were faster in pushing and pulling positive words toward their name than away from it, and they were faster in pushing and pulling negative words away from their name than toward it. Experiment 2 was designed to address the three problems just mentioned.

**EXPERIMENT 2**

The hypothesis of our second experiment was again that motive-congruent movements are more forceful than incongruent movements. Therefore, high avoidance-motivated individuals were expected to produce more forceful movements when they avoid a stimulus than when they approach it.

As discussed above, we suspected that, in the first experiment, our experimental setting had caused the main effect of movement direction on PF. Perhaps both high and low avoidance-motivated participants showed stronger backward than forward movements because the latter movements were more restricted than the former. To avoid this difference between the two conditions, we decided to restrict both approach and avoidance movements in the same way. For this purpose, the participants were to perform aiming movements. In other words, they had to move their arm forward or
backward and to home in on a target in both conditions. In addition, we asked all participants to perform forward as well as backward movements. Thereby, we were able to detect intraindividual movement preferences. We resolved the problem that forward and backward movements are not unequivocally associated with the appetitive or aversive motivational system by untangling approach and avoidance from the physical movement direction. We defined avoidance movements as movements that can increase the distance to the stimuli and approach movements as movements that can reduce this distance. Thus, it also depends on the location of the stimuli whether a movement is an approach or avoidance movement. For instance, if a stimulus is presented in front of the participant, a forward movement would be an approach movement. If the stimulus location is behind the participant, moving forward would be an avoidance movement. This variation of the stimulus location makes it necessary to use acoustic stimuli. In Experiment 1, the valence of the stimuli did not alter the interactive effect of the avoidance motive and the movement direction on RF. We therefore decided to use a neutral sound stimulus that was the same for all trials.

We hypothesized that high avoidance-motivated individuals are more motivated to increase the distance to external stimuli than to reduce it. Consequently, we expected that they would perform stronger forward movements when the stimulus was presented from behind them and stronger backward movements when it was presented in front of them. Therefore, a three-way interaction between movement direction, stimulus location, and the participants’ avoidance motive was expected.

**METHOD**

*Participants*

The initial sample consisted of 58 participants. Two of them were excluded from data analysis because their reaction time or movement time was 2 standard deviations or more above the mean. Of the remaining 56 participants, 49 were female. The age of the sample ranged between 16 and 43 years ($M = 23.77$, $SD = 7.06$). None of the participants had participated in the first experiment. Fifty-four participants were students at the University of Tübingen and received course credit for participation.
Procedure

A male experimenter tested participants individually in a sound-insulated room. As in Experiment 1, the avoidance motive was first assessed with the short form of the Multi-Motive Grid (MMG-S). Cronbach’s alpha was $\alpha = .84$ for the avoidance scale and $\alpha = .79$ for the approach scale in the present sample. Participants were then told that they were participating in a study on the usability of a new assessment tool. Therefore, they were to work on a reaction time task and to evaluate this task afterwards. We told them that we wanted to find out whether forward or backward movements were more comfortable for this task and that they had to try both. Instructions for the task were given on a computer screen. The instruction was to react as quickly and as correctly as possible to a number of acoustic signals presented in random intervals. In one group, the sounds were emitted by a speaker, which was placed in front of the participants. In the other group, the sounds came from a speaker positioned behind the participants. In half the trials, the response consisted in moving the arm forward, and in the other half, participants had to move their arm backward. Movement direction was the same within one block. The order of required movements was balanced across groups. The participants were randomly assigned to either the front- or back-speaker condition. At the end of the experiment, they were debriefed.

Apparatus

The task used in this study is called Vienna Reaction Test (Schuhfried, 1996–2000). It is a part of the Vienna Test System, which is a system for computer-assisted diagnostics. This system includes a specially designed response panel. For the purposes of the current experiment, the panel was fitted into a custom-made frame designed to level the originally sloping panel. All buttons except for the rest and response buttons used in the present experiment were obstructed from the participants’ view by a cardboard cover.

The acoustic signal used in this experiment was a sinus wave with a frequency of 2000 Hz and a duration of one second. The intensity of the signal measured at the participants’ ears was 70 dB. The signal was emitted by a loudspeaker positioned 55 cm above the floor. Depending on the condition, the loudspeaker was placed 50 cm to the front or 50 cm to the back left of the participants’ median plane at an angle of 45 degrees. For each movement direction, one block of 28 signals was presented. The interstimulus interval between two signals was randomly selected and ranged between 2.5 and 6 seconds. Five practice trials were conducted before each block.

Each participant was instructed to position his or her index finger on a metal rest button on the panel and to move this finger to a target button 6.5 cm away as soon the response signal occurred. After the response the
participant had to return to the rest button in order to prepare the response for the next trial. In the forward condition the target button was further away from the participant than the rest button. In the backward condition the panel was turned at 180 degrees so that the participant had to move his or her arm backward because the target button was closer to the participant than the rest button.

Results

Data Analysis Strategy

As in Experiment 1, all analyses were based on multiple regression and all predictors were $z$-standardized. The location of the sound signal (in front vs. behind), participants avoidance motive, and the cross-product of both variables were used as independent variables. Dependent variables were RT and MT (movement time) averaged over movement direction ((forward + backward)/2), as well as the difference of MT for the two movement directions (forward – backward). As mentioned above, MT is a measure equivalent to peak force and therefore an indicator for RF. The mean for all movements and the difference were calculated from the RT and MT medians for the 28 forward and the 28 backward movements. The mean of forward and backward movements was used to test the two-way interaction between stimulus location and the avoidance motive. An analysis of the forward-backward difference was used to test a three-way interaction between stimulus location, avoidance motive, and movement direction. Sex differences were not considered because the sample of male participants was too small. Analogous to Experiment 1, the approach-motive score had an impact neither on RT nor on MT and was therefore not considered. The correlations and descriptive statistics for the dependent measures are presented in Table 4.

The difference between MT for forward and for backward movements was used as the main dependent variable to test the predicted three-way interaction. We expected an effect of the cross-product of the avoidance motive and the stimulus location on this difference. As mentioned in the introduction, MT is inversely proportional to RF. That means that the higher the RF, the smaller the MT. We expected that high avoidance-motivated individuals should produce more forceful backward movements (shorter backward MTs) than forward movements when the stimulus came from in front of them. In contrast, they should show more forceful forward movements (shorter
### Table 4
Descriptive Statistics and Correlations Among Variables (Experiment 2)

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Avoidance Score</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.45</td>
<td>6.04</td>
</tr>
<tr>
<td>2. MT Backward</td>
<td>−.05</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>125</td>
<td>31</td>
</tr>
<tr>
<td>3. MT Forward</td>
<td>.05</td>
<td>.83**</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>123</td>
<td>29</td>
</tr>
<tr>
<td>4. MT (Forward + Backward) / 2</td>
<td>.00</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>124</td>
<td>29</td>
</tr>
<tr>
<td>5. MT Forward–Backward</td>
<td>.15</td>
<td>−.42**</td>
<td>.17</td>
<td>−.15</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td>−1</td>
<td>18</td>
</tr>
<tr>
<td>6. RT Backward</td>
<td>.04</td>
<td>.22</td>
<td>.23</td>
<td>.23</td>
<td>−.03</td>
<td>—</td>
<td></td>
<td></td>
<td>210</td>
<td>23</td>
</tr>
<tr>
<td>7. RT Forward</td>
<td>−.08</td>
<td>.22</td>
<td>.19</td>
<td>.22</td>
<td>−.09</td>
<td>.72**</td>
<td>—</td>
<td></td>
<td>215</td>
<td>33</td>
</tr>
<tr>
<td>8. RT (Forward + Backward) / 2</td>
<td>−.03</td>
<td>.24</td>
<td>.22</td>
<td>.24</td>
<td>−.07</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>213</td>
<td>26</td>
</tr>
<tr>
<td>9. RT Forward–Backward</td>
<td>−.15</td>
<td>.09</td>
<td>.03</td>
<td>.07</td>
<td>−.11</td>
<td>.00</td>
<td>.70**</td>
<td>.44**</td>
<td>4</td>
<td>23</td>
</tr>
</tbody>
</table>

*Note. MT = Movement Time (in ms), RT = Reaction Time (in ms), N = 56, **p < .010.*
forward MTs) than backward movements when the stimulus came from behind them. Even though the movement direction is different, both movements are movements away from the stimulus. We expected no interaction between sound location and avoidance motive on RF when movement direction is not considered. This was tested by a regression analysis with the mean MT for forward and backward movements as the dependent variable.

For exploratory purposes, the same analyses were conducted for RT.

**Movement Time**

A preliminary analysis showed that the mean movement times for forward and backward movements did not differ from each other, \(t(55) = - .52, ns\).

In the first regression analysis, the difference of movement times (MT) for forward and backward movements was regressed on the stimulus location, the avoidance motive, and their cross-product. In this analysis, a three-way interaction between stimulus location, avoidance movement, and movement direction emerged. No other effects reached statistical significance (see Table 5). The interaction is depicted in Figure 3. Negative difference scores indicate that forward movements are more forceful than backward movements (MT is shorter for forward than for backward movements). In contrast, positive difference scores indicate that backward movements are more forceful than forward movements (MT is shorter for backward than for forward movements). As predicted, participants high in dispositional avoidance motivation produced more forceful movements when they had to move away from the stimuli than when they had to

<table>
<thead>
<tr>
<th>Variable</th>
<th>(\beta)</th>
<th>(SE)</th>
<th>(T)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance Motive</td>
<td>.13</td>
<td>.130</td>
<td>1.00</td>
<td>.32</td>
</tr>
<tr>
<td>Movement Direction</td>
<td>-.02</td>
<td>.130</td>
<td>-.12</td>
<td>.91</td>
</tr>
<tr>
<td>Avoidance (\times) Movement Direction</td>
<td>-.35</td>
<td>.132</td>
<td>-2.65</td>
<td>.01</td>
</tr>
</tbody>
</table>

*Note. \(R^2 = .14 (N = 56, p < .05)*.*
move toward them. That means that they produced more forceful backward movements when the stimuli came from in front of them and more forceful forward movements when the stimuli came from behind.

The regression analysis with the mean of the movement times (MT) regressed on the stimulus location, the avoidance motive, and their cross-product yielded no significant effects ($\beta < .05, ns$). Thus, neither the two-way interaction between avoidance motive and stimulus location or the interaction between avoidance motive and movement direction or between movement direction and stimulus location was significant.

**Reaction Time**

A preliminary analysis revealed no significant difference between the mean RT for forward and for backward movements, $t(55) = 1.61, ns$. 

---

**Figure 3**

Experiment 2: Mean difference in movement time (MT) between forward and backward movements (forward minus backward) as a function of stimulus location (in front vs. behind) and of motive disposition computed for values 1 SD below (low) and 1 SD above (high) the mean of the avoidance score. Negative differences indicate that forward movements are more forceful than backward movements (MT is shorter for forward than for backward movements). In contrast, positive differences indicate that backward movements are more forceful than forward movements (MT is shorter for backward than for forward movements).
The same regression analysis for MT was also conducted for RT. The regression of the mean RT for forward and backward movements on stimulus location, the avoidance motive, and their cross-product only revealed a significant effect for stimulus location ($\beta = .47$, $t = 3.76$, $p < .001$). Responses were initiated faster when the sound came from in front of the participants ($M = 201$ ms, $SD = 20$) than when it came from behind them ($M = 226$ ms, $SD = 27$).

When the difference of forward and backward movements was regressed on the predictors, the effect for stimulus location was also significant ($\beta = .34$, $t = 3.59$, $p < .01$). The difference was positive and bigger when the sound came from behind the participants and negative and smaller when it came from in front of the participants ($M = 13$ ms, $SD = 28$ vs. $M = -2$ ms, $SD = 13$). Negative means indicate that RT is longer for backward than for forward movements. Thus, participants initiated backward movements quicker than forward movements when the sound came from behind them. There was nearly no difference when the sound came from in front of them.

Discussion

The main objective of Experiment 2 was to find more evidence for the influence of the avoidance motive on approach and avoidance movements. To test this motive-motor link more stringently than in Experiment 1, we have extended the experimental paradigm in several points.

We suspected that in the first experiment forward movements had been more restricted than backward movements and that this might have been the reason why backward movements had been stronger than forward movements for all participants. Therefore, in the present experiment, we restricted both movements to the same degree. With this modification, no difference in RF between forward and backward movements was found. In addition, it could be shown that the avoidance motive is not unequivocally associated with backward movements. With stimulus location as an additional independent variable, it was possible to dissociate forward and backward movements from approach and avoidance. When the stimuli were presented from in front of the participants, avoidance-motivated individuals executed more forceful backward movements than forward movements. When the stimuli were presented from behind the
participants, it was vice versa. Forward and backward movements were varied as within subject variables. Thus, we can conclude that the avoidance motive fosters avoidance movements and, at the same time, impedes approach movements.

**GENERAL DISCUSSION**

In two experiments we investigated the influence of motive dispositions on approach and avoidance movements. Carver et al. (2000) conceptualized the approach and avoidance motivational systems as a discrepancy-reducing and a discrepancy-enlarging system, respectively. In this broader sense, all activities that bring people closer to their goals and to desired states are discrepancy reducing. In contrast, discrepancy-enlarging activities bring people farther away from undesired states. Physical movements toward and away from objects, respectively, are a specific form of discrepancy-reducing and -enlarging behavior. The present experiments expand on current research on approach and avoidance motivation by directly testing the influence of global motive dispositions (motives) on goal-directed motor behavior in this sense.

The data of both experiments provide convergent support for our hypothesis that the avoidance-motive disposition fosters distance-enlarging behavior more than distance-reducing behavior. We used two measures of response force (RF) as the main dependent variable to test this hypothesis because RF can be seen as a more direct measure than reaction time (RT) to test which variables affect motor behavior (e.g., Giray & Ulrich, 1993). RT is a compound of perceptual and decision processes, as well as of motor preparation, but it doesn’t necessarily offer information about the motor processes themselves. Therefore, one cannot infer from RT exclusively whether people’s motive dispositions influence motor processes. RF, however, is an essential parameter of approach and avoidance movements, which modify the distance between the individual and desired, undesired, and neutral objects. Therefore, we used RF as a new indicator for the motive-motor link.

There is evidence from our data that RT and RF reflect different aspects of information processing. As already shown in the domain of cognitive psychology, the two measures do not share much variance in the present experiments. The correlation between RT and
peak force did not exceed $r = -0.25$ in Experiment 1, and the correlation between RT and movement time was not higher than $r = 0.22$ in Experiment 2. These correlations are very similar to those reported by Giray and Ulrich (1993). In addition, the effects of the avoidance motive and movement direction are not the same on RT as on the RF measures. It was shown that movements that are congruent with a high avoidance motive are more forceful than incongruent movements (congruency effect on RF measures). There is, however, no evidence that congruent movements start sooner than incongruent ones (no congruency effect on RT). In other words, the motive-movement congruency seems to affect the execution, but not the preparation of the movements. At first sight, this finding seems to be disappointing because it would be plausible to assume that the avoidance-motive disposition facilitates the preparation of motive-congruent movements and interferes with the preparation of motive-incongruent ones. As the time needed for motor preparation is a compound of total RT, a motive-movement congruency should reduce RT and incongruency should lead to longer RTs if the preparation is affected. It is, however, not surprising that we didn’t find such an effect because the present paradigm is not suitable for testing motive effects on response preparation.

For the investigation of preparatory processes, other experimental paradigms like the precuing technique suggested by Rosenbaum (1980, 1983; see also Anson, Hyland, Kotter, & Wickens, 2000) seem to be more suitable. The technique of Rosenbaum is a modified choice-reaction-time task in which a certain imperative stimulus requires a participant to perform a specific movement as quickly as possible. Before the onset of the imperative stimulus, a precue provides information about one or several parameters of the forthcoming movement. For instance, the precue may indicate that a finger extension must be performed without specifying the response finger. If the preparatory processes utilize advance information, RT should be shorter with advance information than without it. Such RT shortening has been well documented in the RT literature (cf. Requin, Brener, & Ring, 1991; Rosenbaum, 1983).

2. Movement time is inversely proportional to peak force. Therefore different signs occur for the correlation between RT and peak force and between RT and MT, respectively.
Participants in the present experiments were required to respond as quickly as possible to words or sounds, and they were fully informed about the required movements. The most effective strategy for quick responses within our experimental settings seems to be preselecting the appropriate muscles as well as the level of activity (e.g., Anson et al., 2000). The only uncertainty was that participants couldn’t predict when they had to respond. Since motives are defined as a disposition and the movement direction did not change throughout one set of trials, the required movement was permanently motive congruent and motive incongruent, respectively. The participants could have set the activity parameter higher as a default when the movement was congruent than when it was not congruent. So, they may have preselected the muscles required for the movement and the level of activity according to their motive disposition in advance and kept them constant throughout the trials. No congruency effects on response preparation, and thus on RT, would therefore be expected. Although these assumptions await empirical validation, it seems to be clear that RF and RT are not just two sides of the same coin. Considering both measures may be a further step toward process-oriented research in approach and avoidance motivation.

The present experiments employed two different measures of response force and required different kinds of approach and avoidance movements. Nevertheless, the predicted Motive × Movement interaction was demonstrated in both studies. In Experiment 1 approach and avoidance movements were operationalized as forward and backward movements, respectively. It was shown that individuals high in avoidance motivation produced more force in their backward and less force in their forward movements than individuals low in avoidance motivation. The results of Experiment 2 go beyond those of Experiment 1 because they show that the influence of the avoidance motive on the strength of a response is not tied to the physical movement direction (forward, backward).

High avoidance-motivated individuals performed stronger distance reducing movements than low-avoidance participants, even if completely neutral words or sounds were presented. This is in line with our assumption that a stronger activation of the aversive motivational system elicits stronger avoidance movements. Since the motivational systems are thought to be dispositionally preactivated, no valenced stimuli are needed to allow the motive-motor link to
emerge. Nevertheless, it is plausible to assume that the valence of the stimuli can strengthen or attenuate the motive-motor link.

**Limitations and Future Directions**

In Experiment 1, we predicted that the influence of the avoidance motive on motor activity should also depend on the valence of the presented stimuli. Avoidance-motivated individuals were expected to perform stronger avoidance movements when negative stimuli were presented than after positive stimuli. This prediction was based on the assumption that the more activated, the aversive motivational system, the stronger participants' avoidance movements. The aversive motivational system is expected to be more activated in participants with high avoidance motives and to become even stronger activated when negative stimuli are presented. Surprisingly, the valence of the words had no effect on RF at all. There was an influence neither when the word valence corresponded to the required movement nor when it corresponded to the participants motive disposition.

From the present finding of no effects for word valence on RF, one cannot conclude that the valence of incoming stimuli does not affect the motor system. Recently, Pishyar, Harris, and Menzies (2004) found an attentional bias toward negative faces but not toward negative words in people with social anxiety. They argued that, also in a nonclinical sample, face stimuli were more suitable than words to uncover an attentional bias for negative stimuli. Perhaps the motivational impact of words is not only too weak to uncover attentional biases but also too weak to affect motor behavior. Therefore, in future experiments, emotionally more relevant stimuli like the pictures from the International Affective Picture System (IAPS; see Lang, Öhman, & Vaitl, 1988) should be employed.

Valence × Movement interactions were missing not only for RF but also for RT. In contrast to the findings of Wentura et al. (2000), the match of the stimulus valence and the behavior required (movement direction) did not lead to a decrease in the RT in our experiment. In the study of Wentura and his colleagues, stimulus size changed after the required reaction. It was either enlarged in the approach group or reduced in the withdraw group to simulate an increase and a decrease in the distance to the words, respectively. The illusion to withdraw from or to approach a stimulus may ac-
tivate the avoidance or approach motivational system and thereby enhance the detection of stimuli corresponding to this motivational system (Neumann & Strack, 2000). So, it is possible that the response type (approach or withdrawal) was not involved in the effect found by Wentura and his colleagues. We did not alter the stimulus size after participants’ reactions, and thus our paradigm in Experiment 1 was not suitable for a replication.

Even though it was not the purpose of the present experiments to replicate the findings of Wentura et al. (2000), it would be informative to alter the stimulus size also within our experimental paradigm in future experiments. In Wentura et al.’s study, a decrease in stimulus size was always linked to backward movements and an increase was always linked to forward movements. An independent variation of stimulus size and movement direction would be an alternative way to separate forward and backward movements from approach and avoidance as we did in Experiment 2. Thereby, it could be tested how the avoidance motive influences RF if backward and forward movements result in an illusion of a decrease and an increase in distance, respectively.

It is clear from the findings of the present experiments that the avoidance motive influences motor responses. More theoretical and empirical work is, however, needed to find out what mechanisms account for this effect and why the approach motive had no effect on motor behavior. One reason for the missing approach-motive effect may have to do with the automaticity of appetitive and aversive behavior. Strack and Deutsch (2004) proposed to distinguish between an impulsive and a reflective system. The impulsive system is conceptually more strongly linked to automatic processing, and the reflective system is more linked to controlled processing. The authors state that the impulsive system may be oriented toward avoidance as well as toward approach. Nevertheless, it may be that motor responses guided by the avoidance motivational system are more impulsive than motor responses instigated by the approach motivational system.

Consider a person who encounters a threatening target. He or she may flee or push the target away (fight). Both actions can be impulsive and do not need much conscious control. The avoidance system cannot only impulsively accelerate movements to increase the distance to a target but also decelerate dysfunctional movements to prevent a distance reduction. In contrast to these avoidance-motivated motor responses, most approach-motivated movements seem to be more controlled and multistaged. For example, we approach some-
thing in order to grasp it. This is an aiming movement with at least two phases. There is a ballistic phase, which brings the arm nearer to the target; then, the arm must be decelerated to adjust the movement with respect to the target (see, for example, Schmidt, 1988). This is a more controlled phase. Perhaps the approach motive did not affect RF because the movements to be executed in the present experiments were more ballistic than controlled.

The method of assessing the dispositional activation of the approach and avoidance systems used in the present experiments is based on a semiprojective technique, and the resulting scores are thought to reflect implicit motives, which are conceptually more closely associated to impulsive than to reflective processes. It remains to be tested whether other aspects of the avoidance and approach temperament like Extraversion and Neuroticism, negative and positive emotionality, or behavior inhibition and behavior activation have effects on motor behavior. Even though the different scales share common variance (see Elliot & Thrash, 2002; Gable et al., 2003), they may still have different effects on information processing, and especially on impulsive and reflective processes.

Conclusion

In definitions for motives, it is stated that these dispositions affect perception, emotions, and behavioral tendencies. The purpose of the present experiments was to investigate such behavioral tendencies. It was shown that people’s avoidance disposition does actually affect their motor activity.

Even though we are far from understanding the processes through which motivation affects motor behavior, we think that RF is an important variable in the field of personality and motivation to shed some light on the motivation-motor link. In cognitive psychology RF is an informative dependent variable to assess whether physical stimulus features affect motor processes. Similarly, RF may be useful to assess which features of motivation affect motor processes. As in cognitive psychology, we found that RT and RF are not two sides of the same coin. Both variables are obviously affected differentially by motivational factors. It is a challenge for future research to find out which of the processes occurring between stimulus onset and response initiation and which features of the response itself are influenced by motives and stimulus valence.
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