Affective Congruency between Evaluative Stimulus and Forward-Backward Movements in Unintentional Approach-Avoidance Response

Fada Pan*, Yanyan Zhang & Leyuan Li

Department of Applied Psychology
School of Education Science
Nantong University
Nantong, P. R. China

Abstract

The present study aimed to investigate links between the direction of both left and right arm movements and affective words with the unintentional approach-avoidance response. According to previous studies, we proposed that even though participants do not have intentional approach or avoidance, the arm extension-positive and arm flexion-negative mapping will occur. We conducted a 2×2×2 experiment to ask participants to either move forward or backward to judge the valence of the emotional words with their left or right hand. The results suggested that moving arm forward (arm extension) facilitated responding to positive stimuli and moving arm backward (arm flexion) facilitated responding to negative stimuli, and this association happened similarly in left- and right-arm movement because of barely different motor fluency.

Keywords: Approach and avoidance; Affective S-R compatibility; Arm flexion; Arm extension; Space-valence compatibility effects

1. Introduction

According to embodied cognition, cognitive processes are related deeply to the way people interact with the world (Barsalou, 1999; Wilson, 2002). Many studies were interested in the association between thought and perception and action, and demonstrated that actions linked to valence result in affective compatibility effects in judgments (Markman & Brendl, 2005). The approach-avoidance effect refers to the tendency that human approaches to positive objects and avoids negative ones. Both approach and avoidance motivations have fundamental significance for human functioning, and without those, we cannot survive either mentally or physically (Elliot, 2006).

Many researchers have demonstrated that valenced stimuli automatically triggered the approach or avoidance actions. Chen & Bargh (1999) asked participants to pull or push a lever to respond to emotional words. They found that when the test words were positive, pulling movements were faster than pushing movements and the tendency was reversed for negative words. They defined arm flexion (pulling movements) as an approach behavior that pulling the positive stimuli toward the body, and arm extension (pushing movements) as an avoidance behavior that pushing stimuli away. They interpreted the results depending on the specific-muscle-activation account that arm flexion is avoidance-like muscle movements and the arm extension is approach-like movements.

However, the association between the evaluation and the direction of the arm movements seems not to be invariable when the referent was the object other than the self. Wentura, Rothermund and Bak (2000) have designed a go/ no-go lexical decision task that instructed participants to either press a key attached on the computer screen (i.e. approach) or withdraw their fingers from the pressed key (i.e. avoidance) to respond to the valenced word. In the press condition, positive responses were relatively faster than negative ones, whereas negative ones were relatively faster in the withdraw condition. In their study, the arm extension was defined as an approach action, while the arm flexion was an avoidance action.

Thus, the arm movements cannot seem to be directly connected with approach or avoidance actions. To explained the contradictory results, a series of studies have been conducted based on the conceptualization that approach or avoidance action is a preparedness to decrease or increase the distance between the object and the self (Strack & Deutsch, 2004).

Markman and Brendl (2005) demonstrated a study that shows the participant's name in the middle of a corridor on the screen and positive words or negative words appearing in the front of or behind the name. Participants were instructed to pull or push the lever toward or away from the name. The results showed that regardless of the position of the word, in front of or behind the name, or the direction of arm movements, flexion or extension, moving positive stimuli toward the name was faster than moving it away and vice versa for negative words.

To further explore on distance-regulation accounts, Seibt, Neumann, Nussinson, & Strack (2008) proposed that the determinant of whether a movement is an approach or avoidance action is the active reference point. Approach motions can be construed as moving it to oneself (self-related) or reach it out (object-related) and avoidance motions can be defined as pushing it away (self-related) or stay far away from it (object-related). They manipulated the referent in their study and found that the compatibility effects between valenced stimuli and the direction of arm movement can be changed through the instructions, which indicate either self-related or object-related frame of reference. The results in these two conditions showed an opposite pattern.

In contrasting to motivational accounts, an evaluative-response-coding account has been suggested by Eder and Rothermund (2008), proposing that the mapping between valenced stimuli and arm movements lies on the intentional response label in the task instructions. A standard affective-mapping could be reversed by using a response label of opposite evaluative meaning. For example, an approach labeling action (e.g. toward), regardless of whether the arm is bend or extend, will be connected with a positive connotation, which is congruent with positive valence, and vice versa for avoidance labeling behavior (e.g. away).

However, in support of motivational account, Krieglmeyer, R., Deutsch, R., De Houwer, J., & De Raedt, R. (2010) observed a motivational compatibility effect even though the participants did not have the intention to label their actions with approach or avoidance.

The researches we mentioned above have not considered the influence of the handedness or the used hand. According to the Body-Specificity Hypothesis (Casasanto, 2009), people with different bodily characteristics should form corresponding different thoughts. Handedness is one of our main body specificities. Right-handers have different behavioral patterns from left-handers when they interact with the environment. Right-hand movements are different with the left-hand ones because the flexibility is unbalanced, for example, for right-handers, the action carried out by right hands is relatively more fluent than that by left hands (Casasanto & Chrysikou, 2011; Milhau, Brouillet, & Brouillet, 2014).

Space-valence compatibility effects suggested that for right-handers, right space is relatively positive connoted and left space is relatively negative connoted and vice versa for left-handers (Casasanto, 2009; Casasanto & Jasmin, 2010; Kong, 2013; de la Vega, I., de Filippis, M., Lachmair, M., Dudschig, C. & Kaup, B., 2012; de la Fuente, J., Casasanto, Román, & Santiago, 2014). Nevertheless, even a few minutes of experiencing less fluent with dominant hands relative to non-dominant hands can cause a reversal of the mapping (Casasanto & Chrysikou, 2011). Moreover, when performing a unimanual valence judgmental task, left-handers and right-handers showed no difference with their left hands associated left with positive and right hands associated right with positive because left and right hands are more fluent in the corresponding space (Milhau, Brouillet, & Brouillet, 2014). Fluent actions are positive connoted compared to less fluent actions (Winkielman & Cacioppo, 2001; Winkielman, Schwarz, Fazendeiro, & Reber, 2003; Milhau, Brouillet, & Brouillet, 2014).

Experiments have been conducted to examine how approach and withdraw movement (arm flexion and extension) carried out by right or left arms influence the participants' evaluation of valenced stimuli. Participants were asked to perform actions in vertical space and the findings suggested that right-arm flexion and left-arm extension led to more positive evaluations than right-arm extension and left-arm flexion (Cretenet & Dru, 2004; Dru & Cretenet, 2008).

There are two motivations for this present study. Firstly, the direction of arm movements should have facilitating effects on the judgment of valenced stimuli. Although many previous studies have found that the affective compatibility effect is dissociated with arm flexion or extension and have discussed much about the effect of the given referent and the intentional labels in the instructions, studies on the effect of arm movements itself are still sparse. In our present study, we designed a valence judgmental experiment without any intentional labels on approach or avoidance or any metaphorical intentions (for instance, upwards or downwards). There are many metaphorical expressions showing the association between vertical space and emotional metaphor.

Upwards usually connotes positive meaning, whereas downwards are linked to negative meaning (Lakoff & Johnson, 1980, 1999). We assumed it is also true for “forward” and “backward” because in both Chinese and English expression, “forward” has a positive connotation that refers to greater progress and improvement and “backward” contains negative meanings, for example, “a backward country” refers to a nation that is developing slowly and less successfully than most others. Thus, we predict that moving forward (arm extension) facilitates responding to positive stimuli and moving backward (arm flexion) facilitates negative responses.

Secondly, we found it meaningful to study the difference between right and left arm flexion or extension when not given intentional approach or avoidance label and it would provide insight into further exploration of approach-avoidance effects. Performing actions in vertical space (upward and downward) result in different motor fluency. In order to balance the fluency, we ask participants to perform in horizontal and central space (moving forward or backward). We expect no difference between left and right arms.

We referred to Glenberg & Kaschak (2002)’s work and designed the experiment. We employe a special response pad with only three keys available and these keys queue in a line vertically and horizontally in front of the participants, aligned with the middle of the screen. At the beginning of every trial, participants need to place their index fingers on the central key that is labeled as “O” in the instruction, which has no indications at all. When the emotional word is presented on the computer screen, participants are instructed to press the other keys to judge the valence. We labeled the key that is relatively far from the body as “F” and the other key is “N”, which has no intentional approach-avoidance label or metaphorical connotation. The distance between “F” and “N” is 16 cm, and the central key is around 30-50 cm far from participants. Pressing “F” requires the arm to move forward to the stimuli with arm extension, and pressing “N” needs to withdraw the arm backward with arm flexion. In this way, we predict that when pressing “F” to respond to positive words or pressing “N” to make the negative judgment is relatively faster than the opposite association.

2. Methods

2.1 Participants

Thirty-two students from Nantong University, all native Chinese speakers (read from left to right) and right-handed (self-report and confirmed by observing writing hand), took part in this experiment and were paid for their participation. Participants (20 females, 12 males) were between the age of 19 and 23 years old and had a normal or corrected-to-normal vision. This study was approved by the Human Ethics Committee of Nantong University. Informed consent was obtained from all individual participants included in the study.

2.2 Materials

We selected 120 two-character Chinese words (60 positive and 60 negative), from the Chinese Affective Words System (CAWS) (Wang et al., 2008). We assigned these words to two groups randomly and each of them consisted of 30 positive words and 30 negative words (see Supplemental Material). In each group, the two lists of positive and negative stimuli differed in valence (group1: $t(58)=44.169$, $p<.001$; group2: $t(58)=61.793$, $p<.001$), but were similar in excitement, dominance, and familiarity (all $p>0.05$). 30 other words (15 positive, 15 negative) were selected to constitute a training phase. Words were presented in black, font Courier New, size 36 on a silver background at the screen’s center.

2.3 Experimental Design

There were two blocks in the experiment and one instructed participants to act with right hands and the other were done with left hands. Throughout the experiment, participants had to respond with only one hand, either the dominant or non-dominant hand. The order of blocks was counterbalanced across participants and they had a one-minute rest between blocks. At the beginning of the experiment, a brief presentation would be given for the upcoming task.

2.4 Procedure

Participants were tested individually via a computer and sit at a distance of 50 to 60 cm from the screen. The task was to judge the valence of emotional words presented in the center of the screen by pressing keys. At beginning of every trial, participants were required to put the index finger on the center key. When the stimulus presented on the screen, participants moves their fingers forward or backward to press the F key or the N key to respond. After that, the finger moves back to the central key. That is, the distances from the initial location to the two response keys are equal.

Firstly, a black fixation cross was presented in the center of the screen for 1000 ms and in this period of time, subjects should put the index finger on the central key. Then, a word appeared and remained there until the subjects pressed the key. Participants had to press the appropriate key as quickly as possible, otherwise, the word would disappear after 2000 ms. Half of the subjects are instructed to press the F key for positive and the N key for negative (FPA key set: F-Positive and N-Negative association), and the other half produced reversed responses (NPA key set: N-Positive and F-Negative association). Once answered, the subject had to put the finger back on the central key to wait for next trial. There was a 500-ms blank screen between the two trails. Each block consisted of 30 practices and 60 experimental trials. The whole experiment lasted approximately eight minutes. We measured response times (RTs) from the word onset until subjects gave their response.

3. Results

Only reaction times of correct answers remained in the statistical analysis, leading to an exclusion of 2.47% of data. The accuracy rate of all participants was higher than 93%. Correct trials with reaction times beyond the ± 3 SD range were discarded, considered as anticipations and attentional leaks (3.28% of data). Reaction times and accuracy data were submitted to a 2×2×2 mixed ANOVA, with the factors responding hand (left hands vs. right hands) and valence (positive vs. negative) as manipulated within subjects, and the factor response key set (FPA vs. NPA) as manipulated between participants (see Table 1 and Figure 1).

Table 1 Mean reaction times (ms), accuracy (ACC), and standard errors (SE) for emotional words judgmental task.

			RT		ACC	
Response Key Set	**Key -Test words**	**Hands**	**M**	**SE**	**M**	**SE**
FPA	F-Positive	Right	757.7477	23.8285	.9854	.0074
FPA	N-Negative	Right	814.0734	29.3934	.9667	.0091
NPA	N-Positive	Right	866.9603	23.8935	.9771	.0072
NPA	F-Negative	Right	886.3989	30.8020	.9729	.0070
FPA	F-Positive	Left	792.7434	24.2804	.9938	.0034
FPA	N-Negative	Left	808.2238	23.8173	.9854	.0052
NPA	N-Positive	Left	847.6554	20.4344	.9938	.0034
NPA	F-Negative	Left	886.6092	31.5012	.9729	.0076

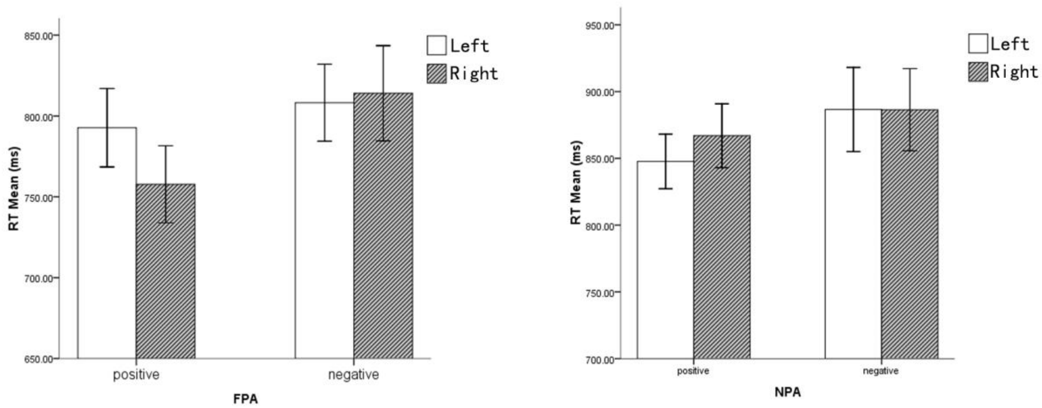

Figure 1. Mean RT of correct responses for the two different types of response device (a: FPA: F-Positive Association, b: NPA: N-Positive Association) as a function of response hand and emotional valence of words in this experiment. Error bars indicate standard error of the mean.

For the accuracy data, there was a significant main effect of responding hand, $F(1, 30) = 10.224$, $p = 0.003$, $\eta^2 = 0.254$, indicating that the accuracy of responses made by left hands was higher than those of right hands. The main effect of valence also reached significance. Positive words tended to be responded more accurately than negative ones, $F(1, 30) = 7.022$, $p = 0.013$, $\eta^2 = 0.190$. No further effects reached statistical significance, $p > 0.05$.

In the reaction times analysis, we found that the main effect for valence was also significant, $F(1, 30) = 7.999$, $p < 0.01$, $\eta^2 = 0.211$, showing faster responding to positive words than to negative ones. The main effect for response key set was significant, and RT tended to be shorter with the FPA response key set than the NPA (508 vs. 558 ms), $F(1, 30) = 5.578$, $p = 0.025$, $\eta^2 = 0.157$. However, the main effect of responding hand did not reach significance, $p = 0.808$. Responding hand did not interact with the response key set ($p = 0.249$), neither did with valence ($p = 0.349$). The interaction between response key set and valence was not significant either ($p = 0.773$).

Finally, the three-way interaction between three factors responding hand, valence and response key set was significant, $F(1, 30) = 7.235$, $p < 0.05$, $\eta^2 = 0.194$. Simple effects analysis for the three-way interaction revealed that when response key set was FPA (F-Positive and N-Negative), the responding hand was right hand, and the test word was positive, participants had faster RT than when the words were negative, $F(1, 30) = 12.68$, $p = 0.001$. However, it did not show a similar trend when response key set was NPA (N-Positive and F-Negative). When making the positive evaluation with right hands, and the response key set was FPA, the RT was significantly shorter than NPA, $F(1, 30) = 10.47$, $p = 0.003$. When responding to positive words and the response key set was FPA, right hands responded faster than left hands, $F(1, 30) = 4.40$, $p < 0.05$. When test words were negative and the responding hand is left hand, participants tended to respond faster on FPA device than NPA, $F(1, 30) = 3.94$, $p = 0.056$.

4. Discussion

The results showed that when participants were instructed to press F (arm extension) to make a positive response and press N (arm flexion) to make a negative response (FPA), the reaction times were shorter than the reversed mapping (NPA). That is, when the instructions did not give any indication of metaphorical information to participants, the arm extension motion was congruent with positive stimuli, whereas the arm flexion motion was congruent with negative stimuli. Moreover, the results also suggested that right arm and left arm had a similar trend that arm extension was relatively faster to judge positive words and arm flexion was congruent with judging negative words. However, this was counter to Chen & Bargh's (1999) findings that arm flexion (pulling a lever) is linked with approach action and facilitates responding to positive stimuli, whereas arm extension (pushing a lever) is connected with avoidance action and has a faster response to negative stimuli. According to evaluative-response-coding accounts, they used self-related instructions to intentionally label arm extension (pushing movement) with avoidance action and label arm flexion (pulling movement) with approach action.

The result was in line with the conclusion of object-related approach-avoidance effect (Seibt et al., 2008), even though there were no implicit self-related or object-related instructions given to the participants such as “toward” and “away”. However, it still had some points need to be clarified. In the study of Seibt et al. (2008, Study 1), participants began each trail with the instruction “ Please put your finger on key A (B)!”, which key A was attached to the computer screen a half inch beneath the stimuli and key B was the “0” key on the num pad. That is to say, key A and B were not only in horizontal space but also in vertical space, for example, release key B and press key “A” need to move arm forward and upward at the same time. Both “forward” and “upward” have a positive implication metaphorically or in the memory of muscle.

The present work studied the question in one spatial dimension with arm move forward or backward in horizontal space. Without intentional labels of approach or avoidance, participants tended to associate arm extension (moving forward) with positive valence and to associate arm flexion (moving backward) with negative valence. This is in line with the work of Krieglmeyer et al. (2010), even though participants had no intentions of approach or avoidance, there was a positive-toward, negative-away match.

Another finding also needs discussion. There is no evidence indicating the distinction between the left and right arm in terms of the affective stimulus-response compatibility effects. This finding is incompatible with the conclusion of Cretenet & Dru (2004) and Dru & Cretenet (2008), which represented a reversed tendency of left and right arm. They found that right-arm flexion and left-arm extension are associated with positive stimuli and vice versa for negative ones. Previous researchers found that left hand and right hand have a distinguished space-valence association and the main reason is the motor fluency. The fluent action is connoted with positive meaning so that when making an affective evaluation, fluent action would have a relatively faster response to positive stimuli.

For example, for right-handers, right hands are more flexible relative to left hands. In their studies, they instructed participants to either lift palm beneath the table top to press the key (arm flexion) or press the key on the table top (arm extension). The former action was to move upward and exert an upward pressure and the latter action was to move downward and exert a downward pressure. The motor fluency between these two actions is obviously different because lift arm needs to overcome the gravity. The flexibility of dominant hands made it easily to balance the motor fluency so that the main influential factor was the connotation of the direction of movement (upward-positive, downward-negative). Nevertheless, for non-dominant hands, motor fluency between the two actions was the critical factor that fluent action (move upward, i.e. left arm extension) was consistent with positive evaluations and vice versa for negative evaluations.

In the present study, the motor fluency between the two motions has no significant difference, as pressing key F and pressing key N were carried out in the horizontal space in the peripersonal space and have the same distance from the initial key. Thus, dominant hands and non-dominant hands should have similar compatibility effects.

In conclusion, whereas many researchers viewed the affective compatibility is independent of arm extension and flexion (e.g., van Dantzig, Pecher, & Zwaan, 2008), the current study suggested the direction of arm movements facilitate or interfere responding to valenced stimuli. Moreover, left or right arm showed no significant distinction in the mapping between the direction of arm movements and affective words.

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Declaration of Conflicting Interests

The Author(s) declare(s) that there is no conflict of interest.

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