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How Susceptible Are We? Effects of Valence and Reward Interactions on Approach and Avoidance Behaviour

Seminaritöö

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Läbiv Pealkiri: Affective Mapping

Tartu 2013

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Abstract

This study was centred on the effect of valence and reward interactions on implicit approach and avoidance motivations and behaviour. As most studies on the subject have been done in valence condition only, the direction was thought to be prudent and a number of hypotheses were made, regarding valence and reward interactions in tasks measuring approach and avoidance behaviour. The hypotheses were tested, using a manikin type approach avoidance task, in which the participants had to avoid and approach valenced and rewarded words based on their grammatic category. Results showed evidence for the hypotheses and also, for some practices already used by professionals in advertising and marketing industries. Results also show some phenomena that merit further research.

Kokkuvõte

See uurimus keskendus valentsi ning sarrustuse interaktsioonidele implitsiitse lähenemis- ja eemaldumiskäitumise ning –motivatsiooni kontekstis. Enamik valdkonnas läbiviidud uurimusi on keskendunud vaid valentsile, seetõttu leiti, et sarrustuse tingimuse lisamine on praktiline ning postuleeriti number hüpoteese, seoses valentsi ja autasu interaktsioonidega lähenemis-eemaldumis käitumise mõõtmisega. Hüpoteese uuriti läbi mannekeeni tüüpi lähenemis-eemaldumis käitumise paradigma, kus osalejad pidid lähenema ja eemalduma valentsi ning sarrustusega sõnadest vastavalt semantilisele kategooriale. Tulemused kinnitasid postuleeritud hüpoteese, pakkusid tõestust mõnedele kasutuses olevatele praktikatele ning viitasid suunda tulevastele uurimustele.

Introduction

Motivations are an integral part of everyday life. Motivation, is what pushes us to do the things we want to do and refrains us from doing the things that we don't want to do. Because of the effects motivation has on our behaviour, it is also a very popular topic among researchers. One aspect of motivations that is considered to be fundamental and basic is the concept of approach-avoidance (Elliot & Covington, 2001; Elliot, 2006).

Approach and avoidance behaviours are different from other types of behaviours, because they are directed – approach behaviours are initiated by positive stimuli and directed towards positive stimuli, whereas avoidance behaviours are initiated by negative stimuli and directed away from negative stimuli (Krieglmeyer, De Houwer, & Deutsch, 2012; Elliot & Covington, 2001; Elliot, 2006).

Because of its fundamental nature, the approach-avoidance distinction has been known for a very long time. It was first described by the ancient Greek philosopher Democritus, and later, in the beginning days of psychology, was utilized by William James, who considered pleasure and pain to be "springs of action" that were exceptional in reinforcing and inhibiting behaviour, respectively (Elliot, 2006). It is also because of their fundamental nature, that approach and avoidance motivations are not only measured in research laboratories, but they also have an influence over our everyday lives outside the lab, in the real world. Elliot (2006) explains, that because of their conceptual structure, approach and avoidance motivations are intrinsically involved with survival and thriving in the real world. Avoidance motivation can only, if effective, result in the absence of negative stimuli or, if ineffective, in the presence of them. The same logic applies to approach behaviour, as it can only lead to the presence of positive stimuli if effective and the absence of positive stimuli if ineffective. Therefore, avoidance motivation facilitates survival whereas approach motivation facilitates thriving. This way, individuals that often use survival mode and avoidance behaviour, even when danger is not imminent, can miss out on rewards and the positive reinforcement that they could have gained when utilizing their approach mechanisms that facilitate thriving. (Elliot, 2006)

Today we know that approach and avoidance motivations truly are powerful at instigating action. They are present all across the animal kingdom and play a very important role in evolutionary survival (Elliot & Covington, 2001). Researchers have found, that not only do approach and avoidance motivations allow us to react faster when approaching explicitly positive or avoiding explicitly negative stimuli, they are also present when intentions or goals to evaluate stimuli as either positive or negative, are not (Krieglmeyer, De Houwer, & Deutsch, 2012; De Houwer, Crombez, Baeyens, & Hermans, 2001). Evidence also shows that consistent responses to negative stimuli (avoidance reactions) have lower overall response latencies, making people the fastest at avoiding negative stimuli (Chen & Bargh, 1999). The most likely reason for this lies in evolutionary theory. Organisms that are faster at avoiding negative stimuli, i.e. predators and dangerous environments survive longer and thus carry their traits forward through their successors. The ability to act quickly and avoid negative consequences is an important evolutionary trait. This is supported by the findings of Guido Peeters (2002), who found, that avoidance behaviour has a larger subjective necessity than approach behaviour.

Implicit approach-avoidance motivation

Implicit effects on approach and avoidance behaviour are possible because of a feature of the unconscious mind, called automatic evaluation. Theorists have postulated, that "because of the late evolutionary arrival of the conscious modes of behaviour and thought, it is likely, that conscious pursuit of goals is making use of the already existing unconscious motivational structures" (Bargh & Morsella, 2008). Reactions to the contextual stimuli can take the form of contextual priming, where the conscious mind is unaware of any reaction taking place, yet associations and representations are activated in the unconscious mind that guide our impulses and behaviours. It is therefore consistent, that if the unconscious evolved as a guidance system for behaviour, using contextual stimuli, that it should be directly connected to behavioural mechanisms. (Bargh & Morsella, 2008)

Evidence has been found to support these postulates by researchers who discovered that people have a universal tendency to nonconsciously classify most, if not all, stimuli as either good or bad (Chen & Bargh, 1999). Automatic evaluations have been proposed to have evolved to prepare an organism for the appropriate course of action, toward stimuli that are currently not in the focus of the conscious mind. This is supported by the fact that there is a direct link between automatic evaluation of a stimulus and the approach-avoidance motivation towards that stimulus (Chen & Bargh, 1999). This link is very important, because it saves time in choosing the right course of action. The time saved by making the decision in the unconscious and putting the body in a state of preparedness, could mean the difference between life and death in situations where danger is imminent.

It is known that approach-avoidance motivations that are based on automatic evaluations put the body in a state of action preparedness to behave in response to the stimulus in a manner consistent with the evaluation (Chen & Bargh, 1999). However, there have been disagreements among researcher about the exact type of behaviour that qualifies as approach-avoidance behaviour. One school of researchers claim that approach-avoidance behaviour should be decided based on the activity of the muscles that have co-occurred with the decrease or increase of distance between the stimulus and the organism – the flexion-extension hypothesis. They claim that only this kind of approach-avoidance behaviour is automatically triggered and positive stimuli will facilitate arm flexion whereas negative stimuli will facilitate arm extension. Others claim that approach-avoidance behaviour is defined by whether the behaviour increases or decreases the distance between the self and the object – the distance-change hypothesis. The experimental paradigms designed to test the hypotheses revealed that although both types of behaviour were automatically triggered, the flexion-extension behaviour was not automatic in the sense that it required the participant to intentionally evaluate the stimulus, whereas the distance-change behaviour did not. (Krieglmeyer, De Houwer, & Deutsch, 2012)

Although it has been stated that any behaviour that increases or decreases the distance between the self and the object can be considered approach-avoidance behaviour and can therefore be triggered by the automatic evaluation of a stimulus, there is still a matter that is in need of further explanation. Objects can be approached or avoided in different manners. This is where the concept of "frame of reference" comes in. Seibt et al. (2008) explained that "when an object frame of reference is more available, approach and avoidance motions are constructed with reference to the object. When the self is more accessible as a frame of reference, then they are constructed with reference to the self." In simple terms, when the self is a frame of reference, we bring objects closer to us or push them away from us to approach and avoid, respectively. When the frame of reference is the object, we move towards or away from the object itself. What matters is that during approach movements we experience a decrease of distance and during avoidance movements, an increase in distance (Seibt, Neumann, Nussinson, & Strack, 2008). It is also shown by Krieglmeyer et al. (2012) that it is the ultimate change in distance that matters, but only when the end result is easily anticipated. This applies to the cases when one needs to approach a negative stimulus in order to avoid it or vice versa. However, if the end result is not anticipatable, for example, you wish to throw a spider out of a window, but you don't know where the open window is, then you would not be faster at avoiding negative stimuli than approaching them and vice versa.

Measuring implicit approach-avoidance reactions

Implicit, as opposed to explicit measures are those that rely on response latencies, other indicators of spontaneous trait association or real behaviour (Steffens & Jonas, 2010). Simply put, when explicit measures need conscious, goal-oriented processing of associations or concepts that are to be measured, then implicit measures do not. As put by Zinkernagel (Hofmann, Dislich, Gschwendner, & Schmitt, 2011) and Gawronski (2009), the explicit system of information processing represents consciously accessible information, whereas the implicit system draws upon information not accessible through introspection. The explicit system predicts deliberate behaviour and the implicit system predicts automatic and spontaneous behaviour. It is also thought, that implicit measures are less susceptible to social bias (Gawronski, 2009; Krieglmeyer & Deutsch, 2010; Maison, Greenwald, & Bruin, 2004).

There are two implicit measures that are most often used to study approach-avoidance behaviour and they are referred to as the joystick task and the manikin task. The joystick task requires participants to move a joystick either towards the stimulus or away from the stimulus in response to the stimulus valence or some other nominal category. Which movement is considered to be approach and which is considered to be avoidance is defined by the instructions. In the manikin task, the goal is to move a manlike figure, a representation of the self, towards or away from the stimulus on a computer screen, in response to similar nominal categories as the joystick task, by using pre-set keys on a computer keyboard or other such apparatus. A study conducted by Krieglmeyer and Deutsch (2010), showed that the manikin task is more reliable in measuring approach avoidance behaviour, because the risk of recategorization is considerably lower. Recategorization occurs in the joystick task when participants stop thinking of their hand movements as approach and avoidance movements, as instructed by the experimenter, and start thinking of them in their own categories that make it easier for them to decide which way to move, for example forward and backward, instead of approach and avoid. Recategorization in the manikin task is far less likely, because the manikin will appear either above or below a word, as decided by a randomization algorithm. This way, participants will not be able to recategorize the movements, because they might differ between trials (Krieglmeyer & Deutsch, 2010).

Recategorization is a problem, because only responses that are coded in terms of approach and avoidance can activate the approach-avoidance schemata that will facilitate the responses (Krieglmeyer & Deutsch, 2010). The experiments conducted by Krieglmeyer and Deutsch (2010) showed that the manikin task is a valid implicit measure of valence-induced approach-avoidance schemata, even in the absence of evaluation goals. The precedent for using the manikin task to study the effects of approach-avoidance facilitation was set by De Houwer et al. (2001), who, by using valenced words, showed, that approach reactions in the manikin task were facilitated by positively valenced stimuli and avoidance reactions facilitated by negatively valenced stimuli, even though the valence of the words was irrelevant and the task did not require semantic processing of the stimulus words.

Disentangling valence and reward in implicit approach-avoidance reactions

Research from other areas has found that a complete affective reaction is composed of a number of subcomponents. Berrdige and Kringelback (2008) have shown, that when dealing with a positive affective reaction, then in terms of physiology and neurochemistry, at least two specific modalities present themselves – wanting and liking. These authors show, that the "liking" part of an affective reaction represents the hedonic element of pleasure and the "wanting" part of an affective reaction represents the desire for reward. Both parts have conscious and nonconscious manifestations. Most existing research on implicit motivational activation however has concentrated on studying the implicit motivational responses to generally positively or negatively valenced stimuli, without identifying the specific components of the affective reactions. The present study is, for the first time, interested in the patterns of implicit motivational activation when intrinsic valence and learned rewarding properties of the stimuli are manipulated independently. Although both valence and reward can activate liking and wanting systems, it is assumed that valence variability causes stronger changes in the liking system while reward variability co-varies with wanting activations. (Berrdige & Kringelback, 2008)

In this experiment, motivational relevance (reward and punishment) was manipulated independently of the intrinsic valence of the stimuli. Because of the above-mentioned methodological considerations, the manikin task was chosen for this experiment. Based on previous research, we hypothesize that both valence and reward induce contingency effects whereby response times are shortened when pleasant as well as rewarding stimuli need to be approached compared to when they need to be avoided (De Houwer, Crombez, Baeyens, & Hermans, 2001; Krieglmeyer & Deutsch, 2010; Chen & Bargh, 1999). In addition, the central research question of the study is how do valence and reward interact in determining implicit motivational responses.

Method

The experiment was a part of a larger study, codenamed ASK (est. "Categorisation of Affective Stimuli"). Testing took place at the laboratory of experimental psychology of the University of Tartu. All participants were tested separately and the testing took place from 10 am to 7 pm, on all weekdays during March and April of 2013. The first tests were conducted under the supervision of my thesis advisor, Andero Uusberg.

Participants

The sample consisted of 20 individuals, of whom 6 were male and 14 were female. Mean age of the participants was 22,16 years and had a standard deviation of 3,61 years. All participants were right handed and were studying at Tartu University when the testing occurred. Participants were initially contacted through mailing lists, social media (Facebook) or posters. Participants were asked to be well rested and not under the influence of stimulants (nicotine, caffeine) during the testing.

Stimulus materials

The stimulus material contained Estonian words. The goal was to find pairs of adjectives and nouns with positive or negative valence that had a similar mean length and occurrence frequency in the Estonian language. Firstly, adjectives that were rated as clearly positive or clearly negative by a group of experts, and that were among the 3000-10000 most used in the Estonian language, were chosen from Vainik's (2012) map of affective valences of Estonian words. Then corresponding nouns were created from each of the adjectives. Pairs with very uncommon nouns were left out. This resulted in 16 positive and 35 negative pairs. Then the closest negative pair was chosen for each positive pair of words, based on word length and occurrence rate. From the remaining pairs, the longest was eliminated form both positive and negative category, leaving the experiment with 15 pairs of positive and 15 pairs of negative words.

Procedure

Before coming to the laboratory, participants were asked to fill out four questionnaires on their own computers, in the Psychology departments' web environment.

Upon arrival, participants were asked to read and sign a form of consent. Once the participants gave consent, they were asked to do a CCF (critical clicker frequency) test. After that, 32 EEG (electroencephalograph) electrodes were placed on the participants' head and a resting-state EEG was measured. Next, the actual experiment began. After the task, resting EEG and CFF were measured for the second time and participants were asked to fill out 3 questionnaires on a laptop computer.

A manikin type approach-avoidance implicit measure was used as the experimental paradigm. The experiment was programmed using the Psychtoolbox extension of Matlab. Responses were given using a standard computer mouse and recorded using the same program. Scroll wheel was used to start each measurement. Left and right keys of the mouse moved the manikin. Left click moved the manikin upward and right click moved it down. The mouse was held parallel to the screen on its side, in a manner that left click would correspond to upward movements and right click to downward movements.

The stimuli were presented on a 19" CRT type computer screen. Participants were sitting approximately 1 meter away from the screen. Instructions were shown to participants on the screen and also given verbally by the experimenter. After reading and listening to the instructions, participants were given the chance to ask the experimenter questions if anything had remained unclear. If all questions were answered and uncertainties resolved, a series of practice measurements helped the participants to get acquainted to the process before the actual measurements began. Another chance to ask for clarification was given after the practice series. If the participants had no questions or the questions were answered, then the actual measurements began.

Participants had to start each individual measurement themselves by pressing the scroll wheel on the mouse. Once the scroll wheel was pressed, a fixation cross appeared in the centre of the screen. In between 0.8 to 1.2 seconds, the manikin, a manlike figure, appeared either above or below the fixation cross. The location (above or below) was calculated by a randomization algorithm. 0.5 seconds after the appearance of the manikin, the fixation cross was replaced with a stimulus word. Participants were instructed to imagine that they were the manikin and to approach or avoid the words according to a simple rule. In order to record the answer, participants had to make the manikin move three steps in either direction from the starting point. In the first half of the experiment they had to approach adjectives and avoid nouns by moving the manikin either towards the words or away from them. In the second half of the experiment the rule was reversed – participants needed to approach nouns and avoid adjectives. 0.5 seconds after recording the answer, a feedback screen appeared, which showed the participants two scores – the points related to the word and the points awarded for the response.

The words were valenced either positively or negatively and presented in either green or red colour. The colours green and red showed motivational reward or punishment, respectively. Reward and punishment were manipulated by the points awarded on each trial. Green words raised the participant's score from 105 to 195 points, determined by a randomization algorithm and red words lowered it in the same range. Points were also given for correct and incorrect answers, depending on the speed of the answer. If the answer was correct, positive points were awarded and if the answer was not correct, negative points were awarded. The faster one was at answering, the more points one received (or had taken away). The response-related scores ranged from 1 to 60 on either positive or negative side. The word-related points scores were written in relevant colour (red for losses, green for wins) to strengthen the associations between outcomes and colours. The response-related scores were presented in white and in 75% smaller font to reduce the relative salience of this contingency. After every 16th answer, another feedback screen appeared that showed the total points earned in the experiment thus far. In order to dismiss each feedback screen and start the next measurement, participants had to press the scroll wheel on the mouse. Because the reward-punishment points for the words were decided by a randomization algorithm and there was an equal amount of positive and negative words, the positive and negative scores given by the words themselves eventually averaged to zero and only the score from the participants answers influences the total score. This is why participants were motivated by promising a reward for the highest score. There were a total of 480 trials per participant, 240 where participants needed to approach adjectives and avoid nouns, and 240 vice versa. The sequence of trials within the two blocks of the experiment was randomized for each participant.

Results

Although three different reaction times were measured, only one was used for statistical analysis. Based on theoretical considerations, I analysed the time it took for the participant to make the first of three movements in the final direction. As three steps were needed to complete a trial, on rare occasions participants first moved the manikin in an erroneous direction and only then moved the manikin in the correct direction, recording the answer. A simple reaction time calculated as the time to first movement would underestimate the time it took to reach the correct decision in those cases. Using the decision reaction time eliminated that limitation.

From the 9600 data points measured, 210 were removed because they had been answered wrongly and another 281 were removed because they did not fit the criteria for applicable data. The criteria were as follows. Based on previous research (Chen & Bargh, 1999), all reaction times less than 0.3 seconds were removed from the lower end. The upper limit was set at 1.82 seconds, which was calculated as the average plus 3 standard deviations (0.8 + 3*0.34).

After this process, 9109 data points remained, the mean of which was 0.77 seconds (min 0.30 s; max 1.82 s) with a standard deviation of 0.25 s. These are also shown in Table 1, below.

Table 1, Descriptive Statistics

Column1	N	Minimum	Maximum	Mean	Std. Deviation
Reaction time	9109	0.30	1.82	0.77	0.25

From this data, average values were calculated for all participants for each condition and a repeated measures ANOVA (Analysis of Variance) was carried out. The main requirement of the statistic was fulfilled as the sphericity assumption was not violated according to Mauchly's test.

The results of the repeated measures ANOVA are as follows.

Table 1, ANOVA Results

	df	F	p	Partial Eta Squared
valence	1	58.138	0.000	0.754
reward	1	15.951	0.001	0.456
task	1	69.254	0.000	0.785
valence * reward	1	0.298	0.592	0.015
valence * task	1	9.628	0.006	0.336
reward * task	1	3.815	0.066	0.167
valence * reward * task	1	1.000	0.330	0.050

There are a few things that should stand out from the results of the analysis. The significant main effects show us that approach reactions are universally faster than avoidance reactions (See Figure 1, F(1,19)=69.254; p=0.000; Partial Eta Squared=0.785), that reactions to negatively valenced words are universally faster than reactions to positively valenced words (See Figure 2, F(1, 19)=58.138; p=0.000; Partial Eta Squared=0.754) and that reactions to words that merited rewards were universally faster than reactions to words that merited punishments (See Figure 3, F(1, 19)=15.951; p=0.27; Partial Eta Squared=0.456).

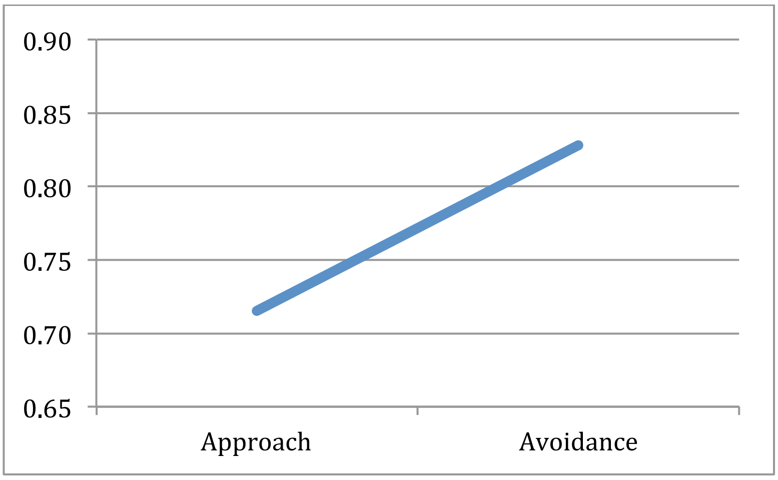

Figure 1, Task main effect

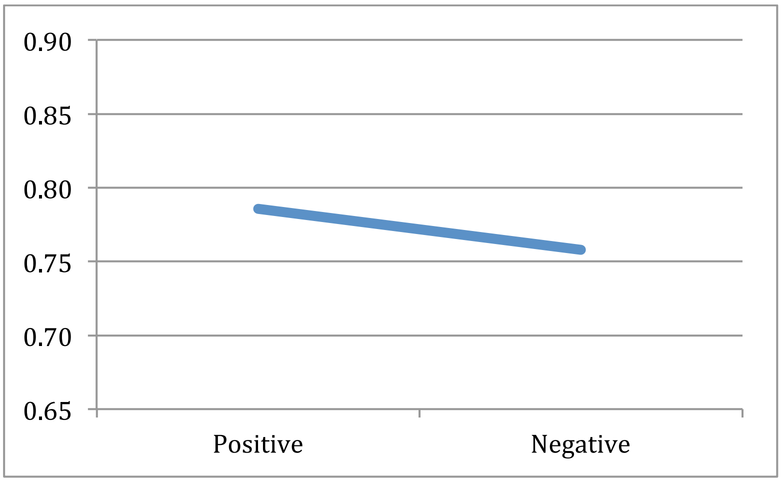

Figure 2, Valence main effect

Figure 3, Reward main effect

The results also revealed a number of congruency effects or interactions involving the approach-avoidance tasks. Firstly, although avoidance reactions were slower overall in either valence condition, negatively valenced words had a more pronounced acceleration effect in avoidance tasks than in approach tasks (See Figure 4, F(1, 19)=9.628; p=0.006; Partial Eta Squared=0.015). Secondly, the accelerating effects of the reward condition were more prominent in the tasks that required approaching, rather than avoiding the stimulus (See Figure 5, F(1, 19)=3.815; p=0.066; Partial Eta Squared=0.167)[1]. Finally, it is important to note that there was no interaction between the valence and reward conditions (F(1, 19)=0.298, p=592; Partial Eta Squared=0.015) nor a 3-way interaction between task, valence and reward (F(1, 19)=1.000; p=0.330; Partial Eta Squared=0.050)

[1] Although the p value classifies this result as insignificant, it is an interesting result and the rate of insifnificancy is so marginal, that a larger sample might prove this to be significant.

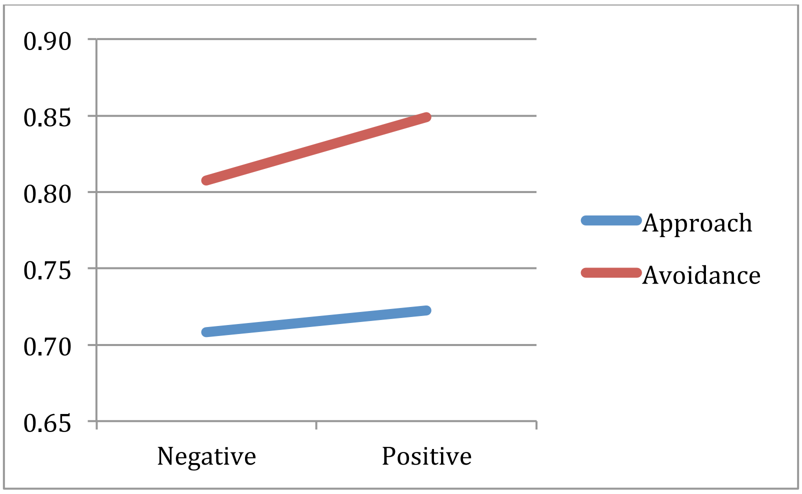

Figure 4, Valence-task interaction

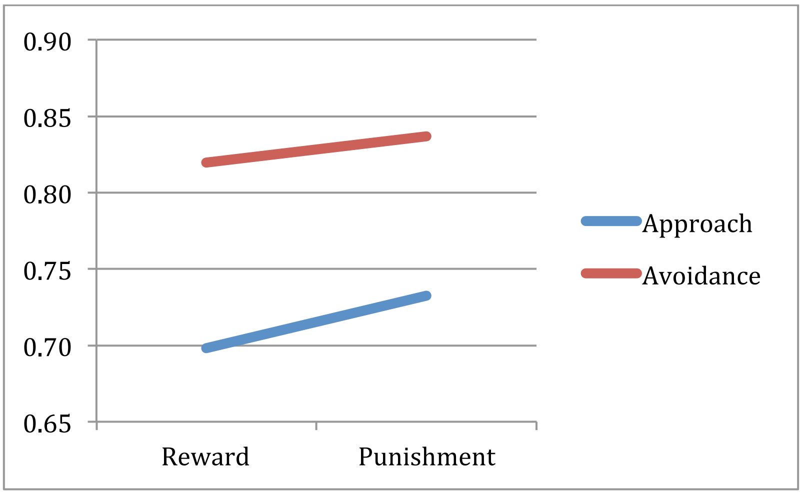

Figure 5, Reward-task interaction

Next to the conditions measured in the experiment, there were a few conditions that were experimentally controlled rather than manipulated, but may have nevertheless had an effect on the reaction times. Those were the grammatical category based rules for approaching and avoiding (block) and the position of the manikin either above or below the stimulus (Manikin). A separate repeated measures ANOVA was carried out on these two conditions to determine whether they had an effect on the results.

Preliminary tests show that when reaction times were compared within these two conditions, then the sphericity requirement according to Mauchly's test was fulfilled.

Results show, that both main effects for the block (F(1, 19)=19.335; p=0.000; Partial Eta Squared=0.504) and the position of the manikin (F(1, 19)=21.435; p=0.000; Partial Eta Squared=0.530) were significant (See Table 5). The effects can be seen on the Figures 6 and 7, respectively. The interaction between the two conditions were statistically insignificant (See Table 5, F(1, 19)=2.212; p=0.153; Partial Eta Squared=0.104).

Table 2, Controlled Factors ANOVA

	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared Squared
Block	0.089	1	0.089	19.335	0	0.504
Manikin	0.012	1	0.012	21.435	0	0.53
Block * Manikin	0.002	1	0.002	2.212	0.153	0.104

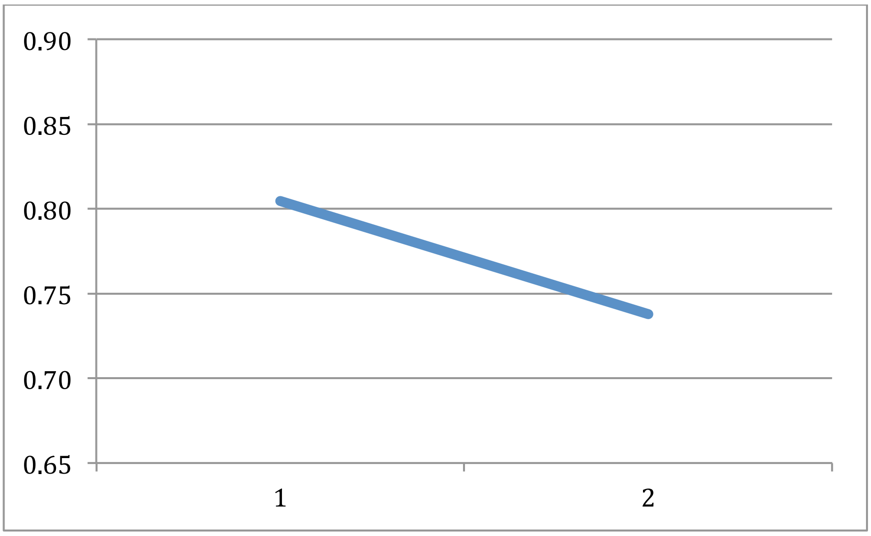

Figure 6, Block main effect

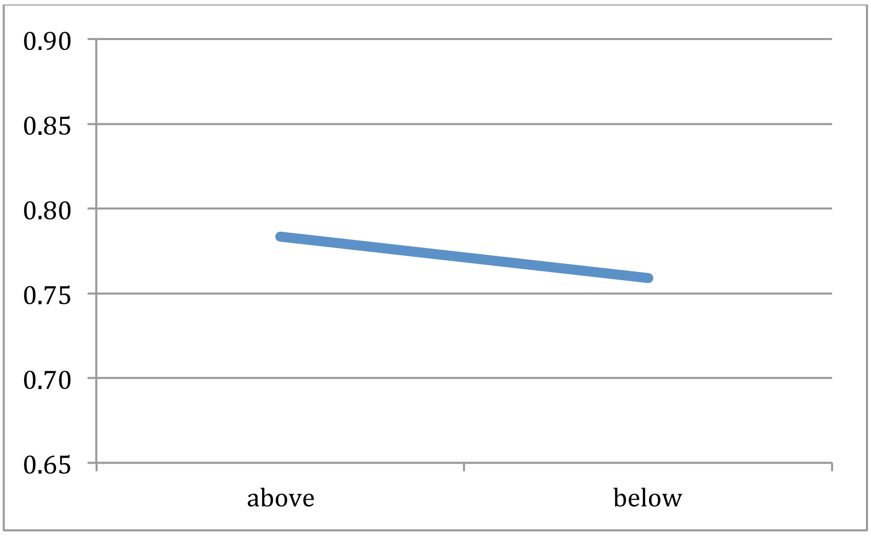

Figure 7, Manikin main effect

All results, implications, limitations and ideas for further research will be discussed in detail in the following section.

Discussion

First the main effects of the three conditions in the experiment will be discussed. The first effect shows us, that no matter the condition, participants were generally faster at moving the manikin towards the stimulus than away from it. This can be interpreted in a number of ways. Firstly, it's not outside the realm of possibility, that participants redefined the instructions to themselves in terms of approaching the stimulus, therefore making the approach movement a default choice for the measurements. For instance in the first block this means that instead of saying to themselves "I will approach/move towards the adjectives or avoid/move away from the nouns," they said "I will approach the word unless it's a noun." This one-sided view of the task might have made it easier for the participants to remember what they have to do, but it also can make approach motions faster than avoidance motions, because the concept of approach had already been primed.

Another way of looking at the effects is based on the idea of learning. This will be explained in more detail further in the text, but there was a learning effect across the two halves of the experiment. This means that participants got better at reacting to the stimuli the more they had practiced it. When this is coupled with the possibility that nouns might have been easier and quicker to recognize, also explained later in further detail, then the results could quite conceivably have been shifted in the direction that approach motions were faster than avoidance motions. This is because the first half of the experiment had to do with approaching adjectives and avoiding nouns. During this half, the participants were still learning to efficiently fulfil the task in front of them, which means that reaction times were slower for both approach and avoidance conditions. However, in the second half, when participants were more proficient in their reactions and also had to approach nouns, then the faster recognisability of the nouns, paired with the overall faster response times as a result of the learning process, could have shifted the spectrum of results so that approach reactions appeared to be faster than avoidance reactions.

The next main effect revealed that reactions to negative words were persistently faster than reactions to positive words. This is congruent with results found by researchers in the past (Chen & Bargh, 1999). It is also in accordance with the theoretical works by Gaillard et al. (2006), who showed that negatively valenced words have faster access to the conscious mind due to nonconscious semantic processing of the words. As mentioned briefly in the introduction, this is most likely the effect of evolutionary adaption. In the times when survival still proved more of a challenge than it does today, then fast and adequate responses to negative stimuli were necessary for our survival, and in evolutionary terms, it was necessary to give our genes a chance to carry on into the next generation. Through natural selection, a mechanism developed that allowed for negative stimuli to reach the consciousness faster than neutral or positive stimuli, and the same mechanism is responsible for reacting quicker to negatively valenced words than to positively valenced words.

The final main effect shows that participants reacted faster to words that were rewarded with a positive score rather than words that merited a negative score. This can be explained in terms of subjective value functions. It has been shown that the subjective value of nominally equal wins and losses can differ in context-dependent manner (Tversky & Kahneman, 1981). More specifically, when choices are framed in positive terms, participants tend to value gains more than losses while negative framing reverses this pattern. It is very likely that the instructions of the present experiment were perceived in positive rather than negative terms. While losses of points did not have any external consequences, the gains were associated with the announcement that highest scorers will receive prizes at the end of the experimental period. Assuming that response speeds correlate with the intensity of subjective value, it would thus be expected that gain trials lead to faster responses compared to loss trials.

Next to the three main effects of the conditions, two interaction effects were found as well. The first of these effects showed that response-accelerating effects of negatively valenced words were most prominent in avoidance tasks. This means that when the presented stimulus was a word of negative meaning, people avoided it faster than they approached it. This result is consistent with research conducted in the past, where valence effects have been found in approach-avoidance tasks (Chen & Bargh, 1999; De Houwer et al., 2001; Krieglmeyer & Deutsch, 2010). It is also congruent with the evolutionary theory explained beforehand. When our predecessors came in contact with a negative stimulus, for example a predator, then the optimal thing to do was to avoid it as quickly as possible - the more and faster one avoided negative stimuli the longer they lived (Elliot & Covington, 2001). In light of this, it seems natural, that people are better at avoiding negative stimuli than they are at approaching them.

The next interaction showed that the effects of positively rewarded stimuli were most pronounced when the task required approaching a stimulus. As mentioned in the introduction, this was the first attempt of trying to manipulate approach and avoidance behaviours through the use of rewarded or punished stimuli. This result is consistent with the hypotheses that approach and avoidance behaviours are mediated by reward conditions. This can be explained in terms that approaching a reward is a congruent response whereas avoiding a reward is a paradoxical response. In the context of thriving, and in evolutionary terms in general, people are more likely to approach a reward than they are to avoid it. People who avoid rewards are evolutionarily not as successful as those that approach them. Because success and rewards are things that people usually strive towards, it therefore seems reasonable to assume that rewarded stimuli are approached faster than they are avoided.

The introduction stated, that a central question in the study was to see how valence and reward interact in determining approach-avoidance reactions. The last important effect, or more of a lack of effect shows, that reward and valence conditions had no statistically significant interactions. Neither was there a 3-way interaction between task, valence and reward conditions. This can be interpreted in two ways. Firstly, this can signify, that the colours red and green that were used to show whether the word was rewarded or punished, were seen as part of the trial, rather than the stimulus word. Therefore they had no real interaction with the valence condition that was a part of the word, rather than the trial. Another way of looking at this would be to assume that reward and valence are handled in different parts of the brain and are processed via different neurobiological or cognitive systems. This has also been noted by researchers in neurology that have discovered evidence for the notion that reward and valence may be processed in different parts of the brain (Yeung & Sanfey, 2004).

Because this was a minimal sample study that could be construed as a pilot, then the real life implications of the results are mostly limited to suggestions that could be researched further. However, it is possible to speculate, that if similar results would appear in further studies with a larger and more representable samples, then the implications would be applicable to the field of advertising and neural marketing. Campaigns and advertisements could be designed, that put pressure on the motivational component of affect, for example, promising compatible rewards for positive stimuli that have already invoked the approach potential, thereby necessitating an even stronger effect on the targeted population. When this is coupled with the ideas of reciprocity, then it could provide a powerful tool in advertising. Although the conecpt of using rewards in advertising and marketing is already practiced to some extent, providing empirical evidence for different kinds of stimuli, rewards and their interactions and effects, could provide us with the knowledge to create advertisements and campaigns that are more efficient in motivating people to act. However, those specifications should be left for further research.

There are some issues to address concerning the limitations of the study. The first things to discuss are the two controlled conditions analysed in the end of the results section. The first regarded the two approach-avoidance conditions of the experiment. The statistical analyses revealed a significant difference in reaction times across the two conditions – reaction times in the second half of the experiment were considerably faster than in the first half. This is most likely caused by a learning effect between the two conditions. As the participants were new to the task in the first half of the experiment, their reaction times were slower. In the second half of the study, they were familiar with the task and the stimuli and had practiced the motions a number of times over the first half. This means that participants had considerable experience for the second half which allowed them to react faster. Another factor was the position of the manikin in relation to the stimulus word. It could appear either above or below the word, which had the positive effect of making it harder for participants to recategorize the tasks, according to statistical analyses, it also had a significant independent main effect on the reaction times of the participants. Participants reacted faster when the manikin was below the stimulus when compared to the manikin appearing above the stimulus. However, this was a controlled condition that had no bearing on the research question and thus was not analysed further.

Both of the previously mentioned effects were nullified by having equal amounts of measurements in all conditions.

Another limitation was the easier recognisability of nouns when compared to adjectives. This came about because all nouns were derived from corresponding adjectives, and therefore had a default suffix of "us" (i.e. ausus, meeldivus, etc…). Based on subjective reports, most participants realized this pattern and thus reduced the need for semantic processing of the stimuli, therefore considerably accelerating the reaction times. This may have caused the results to be distorted in an unpredictable fashion and may have had a bearing on the end results.

The final limitation of the study is size of the sample, which was quite limited. However, since the study can be seen as a guide for further research and was meant to show trends that merit additional exploration, rather than provide evidence for particular theses and hypotheses, the limited sample can be considered appropriate.

Further research should expand on the marginally significant results of the interactions between reward and task conditions. Although a trend was noted, it did not reach statistical significance and should be repeated with a larger sample that could reveal significant effect. Different types of rewards should be considered, with respect to the field of advertising in which the results could be implicated and applied. Also, different types of stimuli and tasks should be studied, that might be encountered more often in real life, for example pictorial stimuli or tasks that require differentiating between objects or categories other than semantic. Then more specific research questions and hypotheses can be developed.

Most importantly, further research should be conducted to explore the notion that reward and valence are processed via different neurological or cognitive systems and investigate the way in which these systems work.

Conclusion

Although the study had some limitations, it yielded interesting results that revealed patterns that can pave the way for further research on the subject. Results revealed that in the context of this particular study, participants reacted faster to negative stimuli than positive stimuli and that approach reactions were faster than avoidance reactions. Interactions between conditions showed, that negatively valenced words accelerated reaction times more in avoidance compared to approach movements. The reward condition had an opposite effect, words rewarded with positive scores accelerated response times more in tasks of approach than avoidance. The last important result was the lack of interaction between the valence and reward conditions. When taken independently, these results provide evidence for practices that are mostly already in use in the advertising industry. When combined with a representative sample and more resources, research stemming from the study could leave us with a fuller understanding of the human affect and the ways in which it functions.

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