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Approaching Spiders:

How Aversive Stimuli Evoke Preventive Approach Reactions in High BAS individuals

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Abstract

To better understand the intricate workings of automatic approach and avoidance and investigate the possibility of inducing approach on aversive stimuli, the present research tested individuals different in Behavioral Approach System (BAS) motivation and their appropriate reactions on valanced stimuli. Spiders as Aversive stimuli and Toy-Cars as Control stimuli moved on a 21.5 inch touchscreen either Towards or Away from the participants. The participants were instructed to react as fast as they could by pressing the stimuli on the screen. In line with the hypothesis the investigation revealed that individuals with different BAS motivations exhibit different reactions on approaching aversive stimuli. While low BAS individuals reacted slower to Spiders than to Toy-Cars in both the Away moving and Towards moving trials (indicating avoidance), the high BAS individuals engaged the Spiders (significantly) faster than the Toy-Cars in trials where the stimuli moved Towards the participants (exhibiting an immediate approach reaction). These findings would then correspond to evolutionary theories on mechanisms that facilitate the survival of individuals and species. Animals and humans alike are believed to exhibit freezing reactions when a predator is moving away, while, if the threat is proximal, exhibit fight or flight.

Keywords: approach, avoidance, implicit motivation, bis, bas, aversive stimuli

Researchers from various fields of psychology have long been interested in the intricate workings of motivational behavior (Eagly & Chaiken,1993, pp. 155-218). Traditionally this type of behavior has been explain in terms of conscious evaluations of the surrounding world (e.g., Allport, 1935; Campbell, 1963; Fishbein & Azjen, 1975; Vallacher & Wegner, 1985). However, research on conscious goal pursuit often failed to predict behavior from reported attitudes. Showing weak or sometimes non-existent relations between attitude and behavior (LaPiere, 1934; Wicker, 1969). As a consequence much of the subsequent research has been focusing on non-conscious motivation and the automatic properties of approaching positive stimuli and avoiding the negative have since been successfully demonstrated by many (e.g., Fazio, 1986; Gilbert, 1989; Bargh, 1994; Greenwald & Banaji, 1995). Thus, the influence of one's attitudes on one's behavior moved from being described in terms of a conscious and intentional retrieval of one's attitude from memory, to a demonstration of automatic attitude activation resulting in approaching or avoiding behavior (Bargh, 1994, .pp. 5).

Several theorists have argued that there are two core systems responsible for the regulation of *approach* and *avoidance* behavior (e.g. Depue & Iacono, 1989; Fowles, 1980; Gray, 1987). One system deals with aversive motivation and avoidance behavior in which the goal is to move away from something unpleasant, whereas the other system deals with appetitive motivation and approach behavior in which the goal is to move towards something desired. Gray (1987) referred to the first system as the Behavioral Inhibition System (BIS), and to the latter as the Behavioral Approach System (BAS). Empirical evidence from various fields have supported these divisions and revealed that both systems are part of the neurobiological foundations of automatic behavior and affect (Depue & Zald, 1993; Winters, Scott, & Beevers, 2000). Correspondingly, Zajonc (1980) demonstrated the automatic nature

of affect showing that reliable affective discriminations (like-dislike ratings) can be made in the total absence of recognition memory.

As such it can be inferred that people tend to automatically classify most, if not all incoming stimuli as either good or bad. Chen & Bargh, (1999) demonstrated that automatic classification of stimuli as either good or bad appears to have direct behavioral consequences. In their experiment participants were required to pull a lever, as quickly as they could, either towards themselves implying an approach reaction towards a positive stimulus that appeared on the screen or away from themselves implying an avoidance reaction from a negative stimulus on the screen. In coherence with the hypothesis they found participants to respond faster to negatively valenced stimuli when pushing the lever away than when pulling it towards them. Additionally participants responded faster to positive stimuli by pulling than by pushing the lever (Chen & Bargh, 1999). Thus, supporting the notion that automatic evaluation of stimuli have direct influences on behavior.

Nonetheless, Chen & Bargh (1999) fall short to demonstrate the important cognitive processes behind *approach* and *avoidance*. Whereas Chen & Bargh (1999) employ flexing of the arm constitutes avoidance and extending constitutes approach, others (Cacioppo, Priester, & Berntson, 1993) have argued the opposite. Contending both views, Markman & Brendl (2005) have shown automatic *approach* and *avoidance* behavior to operate independently from fixed muscular patterns. In their computerized experiments Markman & Brendl (2005) instructed participants to move valenced words towards or away from their own name on the screen. Analysis of reaction time showed participants to move positive words towards their name faster than away, regardless of whether this response required a pushing or a pulling movement. Other recent finds (Seibt, Neumann, Nussinson, & Strack, 2008) seem to support the notion that the action-consequences in terms of immediate distance change are of particular importance. More specifically, positive stimuli are thought to automatically invoke

distance decreasing behavior, whereas distance increasing behavior is invoked by negative stimuli.

In line with these finds Krieglmeyer, Houwer & Deutsch (2010) have examined the appropriate distance changes following presentation of valenced stimuli. Where previous research (e.g. Markman & Brendl, 2005; Seibt, Neumann, Nussinson, & Strack, 2008) only demonstrated immediate compatible distance change (i.e., a positive stimuli would cause distance decreasing behavior and negative stimuli distance increasing behavior), Krieglmeyer, Houwer & Deutsch (2010) found in addition that stimulus valence facilitates even immediate-incompatible distance change if it ultimately leads to a compatible distance change. More specifically, they showed that regardless of the direction of the initial motion participants were ultimately faster to move a manikin towards positive words and away from the negative. Suggesting that valanced stimuli facilitate ultimate distance changing behavior regardless of the initial direction. Thus whether a behavior constitutes an *approach* or *avoidance* seems to be determined by cognitive interpretation of a response in terms of its distance changing effects (Krieglmeyer et. al., 2010).

In recent years, there has been an increasing interest in establishing theoretical links between neurobiological systems, emotion, personality, psychopathology and social psychological motivation such as Behavioral Approach System (BAS) (Carver, 2004). Despite investigations into differences of motivation across personalities (Elliot & Tharsh, 2002) much has yet to be examined concerning the way *approach* and *avoidance* is utilized by diverse groups of individuals. Likewise there are various obstacles concerning methodology of research on *approach* and *avoidance* that have yet to be overcome. For example much of the previous research is conducted in a manner where elaborate and sometimes contradicting instructions are given to participants. Chen & Bargh (1999) instruct participants to pull a lever in order to indicate avoidance whereas Cacioppo, Priester, &

Berntson (1993) instruct the opposite. In Krieglemayer et.al. (2010) participants have to imagine themselves being a computerized manikin and move oneself towards or away from valanced stimuli in order to establish *approach* or *avoidance*, whereas Markman & Brendl (2005) instruct participants to move valanced words towards or away from their own names. Research on evaluative coding (Hommel,1993; Lavender & Hommel, 2007) has demonstrated that the manner of instructing participants affect the way they react to stimuli on the screen. Thus instructing participants to perform specific behaviors becomes a delicate operation that could eventually alter people's reactions in various ways. For example, in order to represent behavior as a unitary whole, Krieglemayer et.al. (2010) presented the pathway of the valanced stimuli before participants were to approach or avoid. Evaluating context beforehand could interfere with the cognitive processes associated with approach or avoidance in such a manner that participants anticipate their behavior. Another obstacle often encountered when conducting *approach* and *avoidance* research is the way participants are represented on the computer screen. While theories like goal contagion provide solid frameworks on how humans identify themselves with abstract (computerized) objects (Aarts & Dik, 2006), approaching or avoiding using once own body is by definition more indicative of once own behavior. Similarly imagining oneself to be a manikin might not be accomplished accordingly. Therefore more realistic testing of *approach* and *avoidance* is preferable.

Overview of the Experiment

To avoid such obstacles the present research is constructed as such that instructions are minimized and approaching or avoiding is solely based upon peoples own physical actions. Thus the present research aims to eliminate these problems while at the same time investigate the possibility of aversive stimuli inducing immediate automatic approach behavior in high BAS motivated individuals. Therefore the present research utilizes moving

stimuli displayed on a touchscreen mounted to a table in a supine position. Participants are merely instructed to press the stimuli as fast as possible in order to make them disappear. To induce ultimate avoidance, images of several types of Dutch spiders have been selected as they are considered well known aversive stimuli (Kendler, Myer, Prescott & Neale, 2001). Moreover, automatic processes are assumed to play a vital role in spider fear (e.g., Merckelbach, de Jong, Muris, & van den Hout, 1996). And finally, considering their properties spiders are convenient stimuli (as opposed to snakes) to be tested on a touchscreen. Both aversive stimuli (spiders) and control stimuli (toy cars) are set to move from the center of the screen Towards or Away from the participants in order to test the influence of aversive stimuli on distance changing reactions of (low BAS vs. high BAS) individuals .

In accordance with recent findings (Krieglemayer et. al. 2010) we first hypothesize to observe different reactions concerning distance increasing stimuli as opposed to distance decreasing stimuli. Whereas people high in BAS motivation have been linked to traits such as impulsiveness (Depue & Collins, 1999), low BAS motivation is linked with unresponsiveness to incentives and a lack of environmental engagement (Depue & Zald, 1993). Therefore we hypothesize that individuals low in BAS motivation exhibit consistent *avoidance* in all conditions (Away and Towards), while individuals high in BAS motivation exhibit *approach* only in conditions where the aversive stimuli move towards them. More specifically, we expect the response latencies of high BAS individuals on aversive stimuli (spiders) to be shorter than those on control stimuli (toy cars) in trials where targets move towards participants and exceed response latencies of control stimuli in trials where targets move Away from them. The expected hypothesis would therefore correspond to evolutionary theories on mechanisms that facilitate the survival of individuals and species (Lang et al., 1997 in Bradley et. al. 2001). Such are the psychophysiological investigations (Bradley, Codispoti, Cuthbert, & Lang, 2001) that have revealed that depending on the context different

action patterns are being activated. For instance when confronted by a predator, animals and humans alike invariably freeze, mobilizing for defense while, if the threat is proximal, exhibit fight or flight. In this view, towards moving aversive stimuli are associated with fight system activation causing high BAS individuals to approach, while aversive away moving stimuli are associated with freezing reaction inducing avoidance.

Method

Participants and design

A sample of 26 Dutch undergraduates (of which 13 males and 13 females) from Utrecht University and Hogeschool Utrecht took part in the experiment, receiving 4 Euro each in return.

Using a full factorial design all participants were presented with 60 trials of a multiple-factor within-subjects design: 2 (stimulus: targets vs control) x 2 (direction: away vs toward) x 5 (y-pos tracks) x 3 (pictures). Prior to the actual experiment the participants got to practice use of a touchscreen by completing 10 trials with black rectangular stimuli moving on different tracks in a random order. All participants were ignorant to the purpose of the study and the experiment. No participant has partaken in a similar task prior to inclusion and all gave their informed consent.

Apparatus and Instruments

The stimuli were edited in Adobe Photoshop CS5, a graphics editing program developed and published by Adobe Systems Incorporated. The experiment was designed in Adobe Flash ActionScript 3.0, an object oriented programming language from the software manufacturer Adobe Systems Incorporated. It allows extensive control and code reusability for building complex Flash applications. The experiment was designed to control stimulus presentation and record responses. The application was run in Internet Explorer 9.

The experiment was presented on a 21,5-inch Medion Akoya E54009 RGB color touchscreen device running Windows XP. The device has a 5ms response time and a display resolution of 1920 x 1080, running a vertical refresh-rate of 50 Hz a second and generating 50 frames a second. The device was mounted on a flat board so to remain supine on the table. As the stimuli have to travel the screen towards or away from the participants the device was rotated 90 degrees so the screen would appear longitudinal to the participant. Thus for all the dimensions width becomes height and height becomes width. The device was pre-positioned at the very edge of the table.

A Dutch version of the BIS/BAS Scales were presented as a self-report questionnaire to assess individual differences in personality dimensions that reflect the sensitivity of two motivational systems, the aversive and the appetitive system (BIS and BAS; Carver and White's, 1994 and Gray, 1987). The BIS/BAS Scales consist of 20 items that can be allocated to two primary scales: the Behavioral Inhibition System scale (BIS; 7 items) and the Behavioral Approach System scale (BAS; 13 items). The BAS scale can be divided into three subscales: Fun Seeking (BAS-Fun; 4 items), Reward Responsiveness (BAS-Reward; 5 items), and Drive (BAS-Drive; 4 items). For an elaborate description of The Dutch version of BIS/BAS Scales see Franken, (2002) and Franken et al., (2005).

Stimuli

The stimulus used in the practice trials was a filled black rectangle with the dimensions of 158 pixels in width and 104 pixels in height. The center of the stimulus would always appear on the horizontal axis of the screen (x-pos: 960px) in a random order on one of the five tracks (y-pos1: 180px, y-pos2: 360px, y-pos3: 540px, y-pos4: 720px, y-pos5: 900px), and travel down or up these tracks with a constant speed of 15 px per frame (see *Figure 1* of Appendix A for a schematic overview of the experiment). The motion was always a straight line Towards or Away from the participant. The stimulus would vanish as it's pressed by the

participant (hit). In case the participant fails to catch the stimulus (miss) buy constantly missing it, the stimulus would travel the entire screen until it contacted the border of the screen and disappear at x-pos: 1920 pixels. After each trial ended (with a hit or miss), there followed a 2-second pause in between subsequent trials.

The background color of the entire experiment including that of the trials was gray (Hex # code: bfbfbf)

Similar to the practice trials the actual experiment used both target and control stimuli of 158 pixels in width and 104 pixels in height. The 3 target stimuli consisted of 3 depictions of different spiders common to Dutch households. The 3 control stimuli consisted of 3 depictions of different toy-cars (see Appendix B, for examples of stimuli). All depictions were taken from the top view as this would be realistic if an object would move on a flat surface. Considering the nature of the depictions, the total interactive area of 158px by 104px was not filled by a stimulus, instead the pictures were stretched (retaining the aspect ratio) upon a 158 by 104 rectangle of the same color gray as the actual background. Thus the stimulus background blended with the actually background yet the interactive dimensions remained 158px by 104px.

In order to facilitate realism drop down shadows were added to the stimuli using Adobe Photoshop CS5. All shadows entailed the same dimensions; Distance: 8px, Size: 5px, Opacity: 73%, Angle: 139 degrees.

The movements of the stimuli on the experimental trials were identical to those of the practice trials. As is consistent with a full factorial design all stimuli were presented once in every possible condition. Thus for example *spider1* moved along every track once in every direction (Towards and Away) in a random order.

Procedure and trials

Each participant received 60 trials (2 stimulus types [target, control] x 2 direction [away, toward] x 5 y-tracks [y-pos1: 180px, y-pos2: 360px, y-pos3: 540px, y-pos4: 720px, y-pos5: 900px] x 3 pictures [spider1.jpg, spider2.jpg, spider3.jpg, car1.jpg, car2.jpg, car3.jpg]).

On arrival at the laboratory, participants were asked to sit as close as possible to the supine positioned touchscreen device at the edge of the table and not to move the chair during the session until it said otherwise on the screen. Participants were instructed to press the stimulus as fast as they could with the index finger to make the stimulus disappear. They were instructed not to use multiple fingers, use their main hand and not to hoover the hand above the screen, instead hold it next to the device after every move. Finally participants were told that after the entire session is completed they ought to sit behind a near stationed computer to fill out a set of questionnaires, as the message on the screen would instruct them so in due time.

To familiarize the participants with the usage of a touchscreen device, participants got a chance to run 10 practice trials. Before the practice trials began a message (in Dutch) would appear on the screen instructing participants to touch the screen in order to move forward with the experiment. After the practice trials ended, another message would appear asking the participants to press the screen in order to proceed with the actual experiment. The experimenter was only present during the first elaboration of instructions and practice trials. Afterwards, the experimenter silently left the room and let the participant finish the entire experiment including the questionnaires in solitude.

During the first questionnaire participants were asked to rate the valance of aversive stimuli (spiders) and that of the control stimuli (cars) on a 5-point Likert-type scale (with 1 being “not repulsive” and 5 “extremely repulsive”). After the completion of the stimuli ratings the participants were asked to rate 9 self-made Likert-type 5-point scale statements

(such as: *"I would easily pick up a spider"* or *"I am not afraid of spiders"*, with 1 being "absolutely disagree" and 5 "absolutely agree"). And finally a Dutch version of the BIS/BAS questionnaire was presented for assessment of the amount of BAS motivation in different individuals.

Debriefing

After the completion of the experiment and all the questionnaires, participants were checked for awareness of the hypotheses of the research and explained that they could not be made aware of the purpose of the study as it could spread around the campus and interfere with other participants. Instead participants were given a simplified explanation of the study being about approach and avoidance of aversive stimuli.

Results

The main dependent variable was the time it took participants to respond to an aversive stimuli when it was moving either Away or Towards them. Median response latencies for each condition were analyzed in the General Linear Model within subjects design with standardized BAS motivation scores as a continuous variable.

This analysis revealed the hypothesized significant main effect for the Direction of motion (Towards, Away) $F(1, 24) = 19.23$, $p = .000$, $n = 26$ suggesting different reactions to distance decreasing and distance increasing stimuli. No such effect was observed for the Stimulus type (Target, Control) $F(1, 24) = 2.08$, $p = .16$. In addition no significant interactions have been found between Stimulus type and standardized BAS scores $F(1, 24) = 2.05$, $p = .17$, nor between Direction of motion and standardized BAS scores $F(1, 24) = 2.61$, $p = .12$. Although the analysis did reveal a significant 2-way interaction between the Stimulus type and Direction of motion, $F(1, 24) = 6.53$, $p = .02$, the 2-way interaction is qualified by the expected 3-way interaction between the types of Stimuli, Direction of the movement and the amount of BAS motivation $F(1, 24) = 4.63$, $p = .04$, requiring additional analyses.

In order to further examine the 3-way interaction and test our specific hypothesis, the effects of Direction of motion and Stimulus type were assessed for individuals with high BAS motivation (one standard deviation above the mean; see Aiken & West, 1991) and for individuals with low BAS motivation (one standard deviation below the mean) separately. Low BAS participants showed only main effects for Direction $F(1, 24) = 17.84$, $p = .000$ and Stimulus type $F\ (1, 24) = 4.13$, $p = .053$. They were faster on Towards (M = 524ms) than on Away (M = 537ms) trial and faster on control (M = 509ms) than on target (M = 553ms) trials (see *Figure 1*). In contrast to low BAS individuals, high BAS participants revealed an interaction between Away and Towards trials $F(1, 24) = 11.06$, $p = .000$.

As is seen in *Figure 1* low BAS individuals displayed similar avoidance reactions in the Away and Towards trials by reacting slower to aversive target stimuli than to control stimuli. The high BAS individuals on the other hand, did not respond significantly different on Away trials $F\ (1, 24) = 3.52$, $p = .07$ with an overall faster reactions on *control* stimuli (M = 563ms) than on *target* stimuli (M = 579 ms), yet in the Towards trials displayed approach with significantly faster responses $F\ (1, 24) = 4.80$, $p = .04$, on *target* stimuli (M = 543ms) than on *control* stimuli (M = 560ms) (see *Figure 2*).

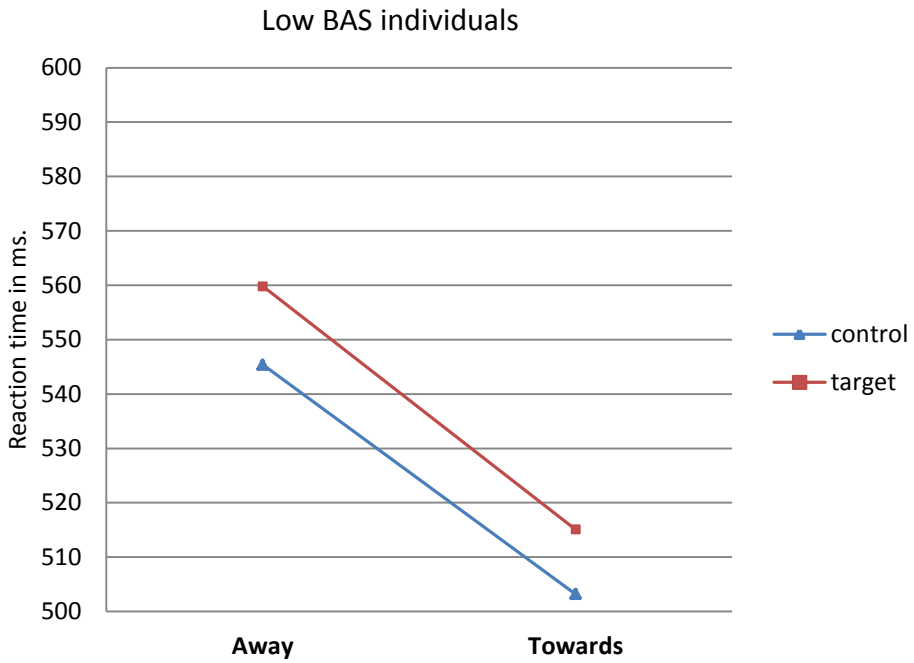

Fig. 1. Mean reaction latencies (in ms) of individuals with low BAS motivation in Away and Towards trials. Low BAS individuals reacted faster on control stimuli (cars) than on aversive stimuli (spiders) in both Away and Towards trials with overall faster responses on Towards than Away trials.

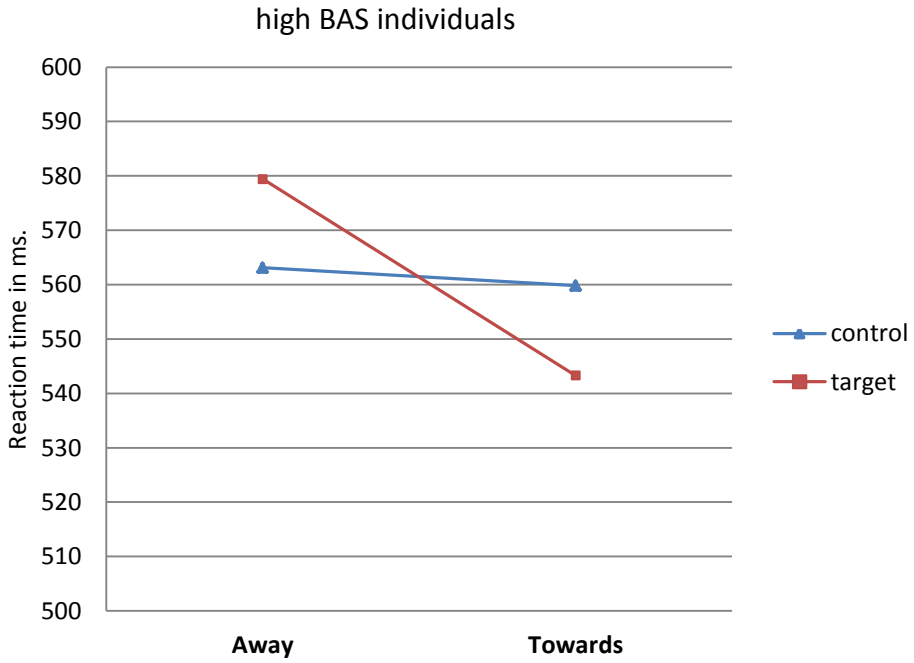

Fig. 2. Mean reaction latencies (in ms) of individuals with high BAS motivation in Away and Towards trials. While high BAS individuals reacted (not significantly) faster to control stimuli (cars) than to target stimuli (spiders) in the Away trials, their reactions reversed in the Towards trials. In contrast with the Away trials high BAS individuals scored (significantly) faster on target stimuli (spiders) than on control stimuli (cars) in the Towards trials.

Thus in accordance with the hypothesis individuals highly motivated to approach responded faster to aversive stimuli than to control stimuli when the distance to aversive stimuli decreased.

Furthermore, no correlations where found between the deferent BAS individuals and the repulsiveness evaluations of the stimuli, attesting to the notion that the differences in low and high BAS motivated individuals were not caused due to different perceptions of stimuli. However, two noteworthy correlations were found between BAS and the self-made Likert-type statements: *"I would easily pick up a Spider"* $r(24) = .42$, $p = .03$ and "*I don't get easily nervous of spiders"* $r(24) = .49$, $p = .01$. The positive significant correlations indicate that higher BAS individuals are less frightened of picking op spiders and get les nervous of them, supporting the approach motivation in high BAS individuals.

Discussion

The present study set out to investigate the possibility of aversive stimuli inducing immediate automatic approach behavior by more realistic means. Therefore participants were presented with moving stimuli on a touchscreen with a simple instruction of pressing the stimuli as fast as they could. Thus contrary to much of previous research on approach and avoidance behavior (e.g., Chen & Bargh, 1999; Markman & Brendl, 2005; Krieglmeyer et. al., 2010), the present research did not request people to perform diverging tasks in different conditions or use computerized representations of themselves. Rather the present research simply measured peoples own physical reactions to a set of valanced and neutral stimuli. As was initially hypothesized the results revealed different latencies for Away and Towards moving trials. These results could indicate a different motivational reaction on Away and Towards moving stimuli. However, because of the limitations of the experiment this conclusion cannot be made with certainty. The experiment was implemented as such that

Towards moving stimuli always remained more proximal to the participant and thus easier to reach and faster to respond than the Away moving stimuli.

Nevertheless, the more important hypothesis for which the study was set up, revealed a profound difference in approach and avoidance reactions of differently motivated individuals. As was initially expected, the results confirmed that while the low BAS individuals avoided aversive stimuli on trials where stimuli moved Away from them and Towards them, the high BAS individuals displayed immediate approach reactions on Towards trials (by responding faster to aversive than to control stimuli). Thus the results revealed that people who are highly motivated to approach (high BAS) actually do so automatically when the aversive stimulus is approaching, yet abstain from approaching when the stimulus moves away from them. Differently, people who are les motivated to approach (low BAS), simply avoid aversive stimuli by responding faster to controls (cars) than to targets (spiders). Furthermore no correlations were detected between the ratings of aversive stimuli and BAS motivations, supporting the assumption that reaction differences between low and high BAS individuals are cause by differences in BAS motivation, instead of perceptual or emotional differences regarding spiders.

These results correspond to Markman & Brendl's (2005) conclusions that automatic approach and avoidance operate independently from fixed muscular patterns. Moreover, the present study is in line with recent finds (Krieglemayer et.al., 2010), that depending on the context people can exhibit immediate approach (by decreasing the distance to aversive stimuli) in order to establish ultimate avoidance (make the aversive stimulus disappear). In addition the present study showed that depending on different motivations (low BAS vs high BAS) people react differently to the same stimuli. As such these results resemble evolutionary theories and psychophysiological investigations (Bradley, Codispoti, Cuthbert, & Lang, 2001) asserting that depending on the context different action patterns are being

activated to facilitate the survival of species (Lang et al., 1997 in Bradley et. al. 2001). If for example an aversive stimulus like a spider is moving away, people would rather exhibit a form of freezing reaction motivated to let it go rather than engage. However if the spider approaches, depending on individual motivations (such as low and high BAS), people exhibit a form of preventive fight or flight reaction by engaging (high BAS) or rather withdrawing (low BAS). These processes occur automatically and fairly rapid. As Zajonc (1980) so cleverly puts it: *"A rabbit confronted by a snake has no time to consider all the perceivable attributes of the snake in the hope that he might be able to infer from them the likelihood of the snake's attack, the timing of the attack, or its direction. The rabbit cannot stop to contemplate the length of the snake's fangs or the geometry of its markings. If the rabbit is to escape, the action must be undertaken long before the completion of even a simple cognitive process—before, in fact, the rabbit has fully established and verified that a nearby movement might reveal a snake in all its coiled glory."*

An unexpected outcome, however not significant one, was the overall reaction times of low and high BAS people. While logically one would expect faster reactions from people highly motivated to approach, people low in BAS motivation responded overall faster to all stimuli in all conditions (see *Fig.1* and *Fig.2*). These differences were not statistically significant yet they are unexpected. Perhaps they can be explained by a cognitive difference between low and high BAS individuals in reacting to stimuli.

Moreover it is worthy to note that while the present study revealed approach reactions from high BAS individuals to images of spiders, other aversive stimuli might not have elicited the same effects. It can be assumed that spiders in particular are aversive animals yet not as strongly unapproachable as for example a scorpion or a snake. Thus it can be expected that the discovered effects do not generalize across all aversive stimuli. In addition it should be noted that all spider pictures used in the experiment were common to Dutch households,

making them more familiar and relevant to Dutch participants. Therefore selecting suitable stimuli is a delicate matter. However, because BIS/BAS questionnaires have been found to correlate in a theoretically meaningful way with extraversion, neuroticism, psychoticism, and impulsivity (Smits & Boeck, 2006; Franken, Muris & Rassin, 2005) it can be inferred that these effects can be generalized across different personalities depending on the context. Further research including multiple types of personalities could shed new light on the matter and possibly establish predictive models of behavior depending on personalities.

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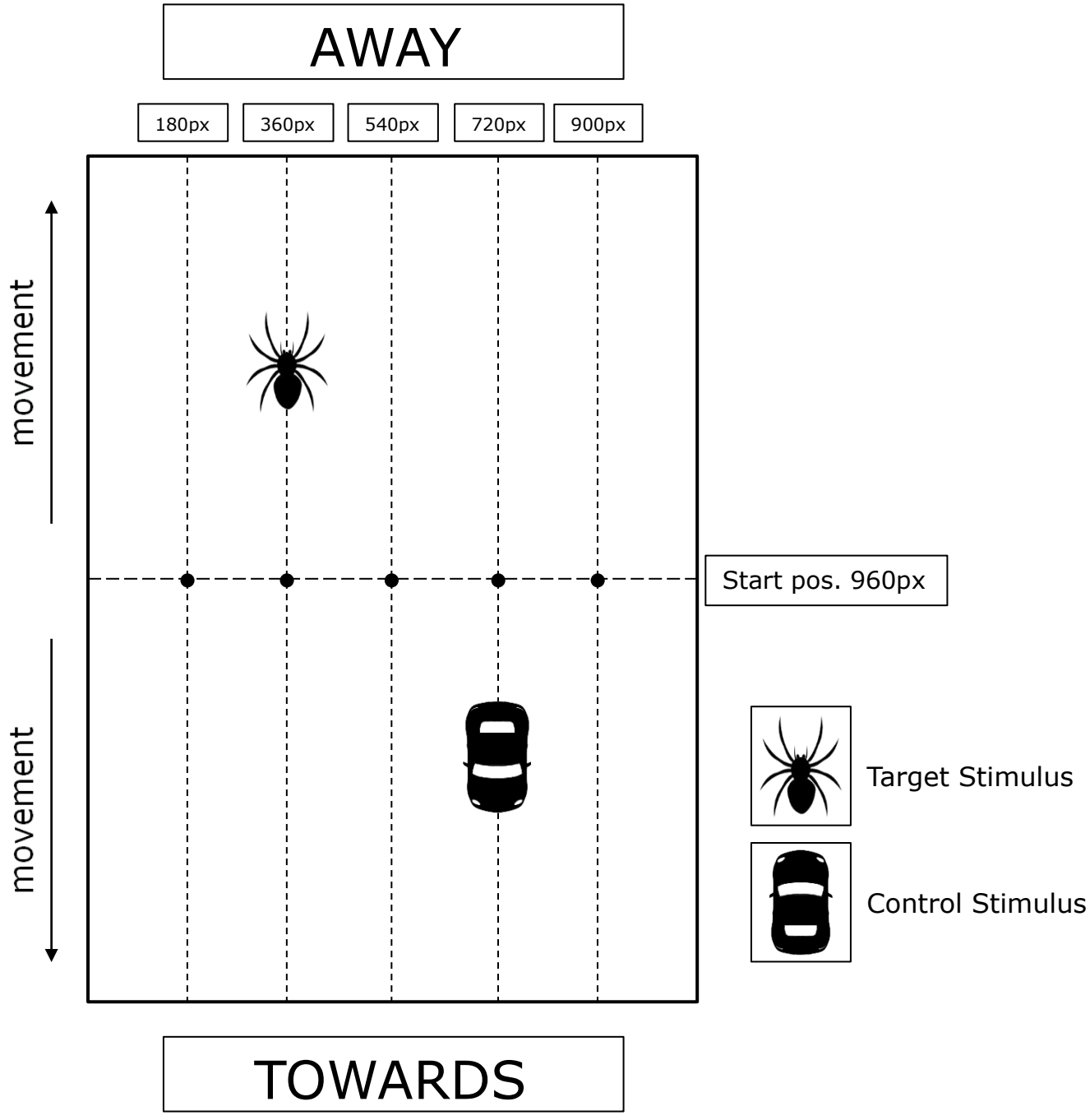
Appendix A

Figure 1. *Schematic display of the experiment with moving Stimuli. The dotted horizontal line at the center indicates the starting positions on 5 points (with the appropriate x-axes pixel position). The 5 dotted vertical lines indicate 5 lanes on which the stimuli travel (one at a time) from the center either AWAY or TOWARDS the participant (with their appropriate y-axes pixel positions). The arrows indicate the direction of stimuli motion from the center. The Spider is a representation of a Target stimulus and the Car represents Control stimulus.*



Appendix B

Stimuli