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A threat to oneself or others slows response time on a spatial cueing task and this effect is strengthened for more pro-social and more anxious people.

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Citation

Methorst, N. (2023). *A threat to oneself or others slows response time on a spatial cueing task and this effect is strengthened for more pro-social and more anxious people.*

Version: Not Applicable (or Unknown)

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Note: To cite this publication please use the final published version (if applicable).



A threat to oneself or others slows response time on a spatial cueing task and this effect is strengthened for more pro-social and more anxious people.

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Word count: 10871
Cognitive Psychology
Thesis Msc Applied Cognitive Psychology

Abstract

Visual attentional selection is an essential mechanism for processing relevant stimuli in our surroundings. Visual attention can either be directed by environmental factors or be controlled voluntarily. Previous research has shown that attentional performance can be enhanced by punishment based on task performance. However, whether attention can also be influenced by a punishment to another person has not been researched yet. In the current study, we used an exogenous spatial cueing task to assess the effects of punishment in the form of a shock on visual attention. The interaction between social value orientation (SVO-shock and SVO), trait anxiety (STAI) and behavioral inhibition (BIS) with the punishment conditions on task performance was examined. Results showed that response time was slower in both punishment conditions. It was slower for people who are more pro-social and people who are more sensitive to punishment, but not for people who are more pro-social on the original SVO measure. People with a high trait anxiety had a slower response time in the 'shock to other' punishment condition. To our knowledge, this is the first study that provides evidence that there is a correlation between the degree of pro-sociality and punishment sensitivity of a person and a slowed response to an exogenous target stimulus in a punishment condition when performing a spatial cueing task. It is possible that this effect was found because people experienced distraction from the task as their attention was drawn towards the source of the punishment.

Keywords: Visual attention, self, other, social value orientation, social motivation, threat, punishment, shocks.

Laymen's abstract

Paying attention to the things around us is essential to both our survival and that of our loved ones. However, our brains can only process so much at the same time. Sometimes our attention is grabbed by things in the environment, while other times we choose what to focus on. Previous research has shown that getting rewarded or punished for bad performance on a visual attention task leads to improved performance. However, it has not been researched yet if someone else receiving punishment for one's own performance has similar effects. In this study we tested how punishment to oneself or another person affects the ability to pay attention to a target and the ability to ignore a suddenly appearing cue. The punishment was a mild shock to the fingers. We also asked participants questions to understand how they feel about others and themselves receiving a reward or a punishment and how anxious they are in general. We found that people generally responded slower in both punishment conditions. This effect was stronger for people who were more sensitive to punishment and cared more about others being punished. People who were more anxious compared to less anxious were only extra slow to respond when someone else got punished. It is possible that this effect is due to attention being distracted from the task towards the source of the punishment. This is the first study that investigated how punishment affects the ability to pay attention for people with more or less pro-social preferences. This research underlines the need to fully understand the relationship between punishment, social behavior and attention.

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Introduction

In the fast pacing and ever-changing world that we live in, attention is needed to guide us through our day-to-day activities. People cannot attend to all stimuli at once as the brain's capacity to process everything in the environment is severely constrained. Visual attentional selection allows us to focus on something, thereby enhancing relevant and inhibiting irrelevant information (Bucker & Theeuwes, 2016). For example, in a busy traffic situation we need visual attention to focus on a specific, relevant part of the crossroad. But how do we determine what to select? And what factors in the environment influence this selection? In the current study we will investigate how punishment in the form of a shock can influence visual attention.

Theory distinguishes between two types of visual attentional control: stimulus-driven and goal-directed (Chun & Marois, 2002; Zadra & Clore, 2011; Egeth & Yantis, 1997; Posner, 1980). Stimulus-driven factors are 'external' factors related to stimuli in the environment, sometimes called exogenous. Such stimuli are salient, which means that they stand out from the environment, for example suddenly appearing or blinking stimuli (Egeth & Yantis, 1997; Yantis, & Jonides, 1984). They automatically draw attention towards them without the voluntary control of the perceiver. Shifting attention towards a salient stimulus is also referred to as stimulus-driven control and is considered a fast, transient process. Goal-directed factors on the other hand are 'internal' factors, related to voluntary control or a certain goal, also called endogenous. For example, when people aim to find a specific person in a crowded area (Libera, & Chelazzi, 2006). Shifting attention in a goal-directed way is under conscious control of the perceiver. For instance, when reading a text, attention is actively being oriented towards the next word or sentence. This is an example of voluntary engagement, but goal-directed control of attention can also be used for disengagement, like

reorienting attention from a salient, non-relevant stimulus, toward a more relevant stimulus. Recently, research has indicated that there is even a third type of factor that influences visual attention, related to what you previously attended to, called selection history (Awh et al., 2012). However, this is beyond the scope of the current study.

The spatial cueing task

One way to research goal-directed and stimulus-driven control is by using a spatial cueing task (Posner, 1980). There are two versions of this task: One is made for measuring goal-directed attention, called an endogenous spatial cueing task, while the other is made for measuring stimulus-driven attention, called an exogenous spatial cueing task. In the task, participants are asked to fixate their eyes on a fixation dot. The task thus measures attention without eye movement, also called covert attention. A central or peripheral cue, either correctly predicts (valid trial) or incorrectly predicts (invalid trial) the subsequently presented target to which participants have to respond. The target is presented left or right of fixation. In the endogenous spatial cueing task, the cue is indicative of the location of the target in more than 50% of the trials, and can thus be used for goal-directed purposes. Such a cue is often an arrow presented at fixation, indicating where the participant has to attend. In the exogenous spatial cueing task, it is important that the cue is exactly 50% of the time valid so no information can be gained from the cue. Additionally, the cue needs to be salient in order to draw attention involuntarily, for example having a sudden onset in the periphery.

Research has shown that on valid trials performance is enhanced relative to invalid trials, as attention is oriented towards the target location (Posner, 1980; Engelmann & Pessoa, 2007; Engelmann et al., 2009). On invalid trials, on the other hand, reorientation of attention to the target location is needed, which causes performance costs (Posner, 1980; Engelmann & Pessoa, 2007; Engelmann et al., 2009). Orientation and reorientation are considered to be two

different processes (Engelmann et al., 2009). Orientation entails engagement and is the process by which we actively attend and process a visual stimulus (Posner & Cohen, 1984). Reorientation on the other hand also requires disengagement from the previously attended stimulus, thus this is an inhibitory process followed by orientation towards a new stimulus (Posner & Cohen, 1984).

Previous research has shown that emotional stimuli can influence reorientation by capturing and holding attention automatically. For example, a study of Fox et al. (2002) showed that in a spatial cueing task, with either happy, angry or neutral faces as a cue, participants were slower to respond on invalid trials when the cue was emotional compared to neutral. This indicated that faces with an emotional valence captured attention longer, increasing the cost of reorientation. Similar results have been found using threatening words as cues (Fox et al., 2001). Thus, not only the physical salience of a stimulus influences attention, also the emotional valence of stimuli can.

Motivational states

Besides the emotional valence of stimuli, physical or mental states of a participant can also influence visual attention (Mog et al., 1998; LaBar et al., 2001; Stockburger et al., 2009). For example, a hungry state can lead to increased attention being drawn towards food related stimuli. This was shown in a study by Mog et al. (1998) in which they used a dot-probe task. Participants were shown very briefly (subliminally) presented food words and transport words that were located in opposite parts of a visual field (e.g. top/bottom, left/right). Participants did not consciously perceive these words and had to indicate the location of a probe that appeared in the same location as one of the type of words. Response time for hungry participants was shorter when the location of the dot was indicated with food related words compared to the transport related words, even though participants were unaware of the

words. This showed that there was an attentional bias towards food related stimuli when hungry.

A mental state that influences visual attention is anxiety. Research has shown that anxiety disorders are related to an attentional bias towards, combined with a difficulty to disengage from, threatening stimuli (Cisler, & Koster, 2010). Results on attentional performance related to anxiety are mixed as some studies showed improved performance on visual attention tasks under stress (Momin et al, 2020; Janelle, 2002), while other studies showed decreases in performance and processing efficiency (Murray & Janelle, 2003; Eysenck et al., 2007). A review by Robinson et al. (2013) has discussed these conflicting findings and suggested a role of processing loads: With high enough task demands all attention is located towards the task, while with low task demands, attention might be distracted by threatening stimuli or worry (Robinson et al., 2013; Eysenck et al., 2007). In addition, anxiety has been proposed to increase attention towards (both neutral and emotional) salient stimuli by increasing stimulus-driven attentional control (Eysenck, 2007). For the entire discussion on this topic, see Robinson et al. (2013) and Eysenck et al. (2007).

Eysenck et al. (2007) also found evidence that stimulus-driven attentional control for both neutral and threatening stimuli in more anxious individuals is more affected by threat compared to less anxious individuals, leading to a higher distractibility. This could indicate that threat of punishment might differentially impact high compared to low trait anxious people. In addition to trait anxiety, sensitivity to punishment might also influence the effect of a threat on visual attention. Reinforcement sensitivity theory aims to explain individual differences in behavior based on three neurological systems that influence behavior: The behavioral inhibition system, the behavioral activation system, and the fight-flight-freeze system (Gray & McNaughton, 2000). Responses to negative stimuli, like punishment or

threat, is thought to be controlled by the behavioral inhibition system (Gray & McNaughton, 2000). A questionnaire that aims to measure the sensitivity of this system is the behavioral inhibition scale (BIS) (Carver & White, 1994). Behavioral inhibition often leads to avoidance behavior and is related to, but not the same as anxiety (Gray & McNaughton, 2000; Corr, 2008). Activation of the behavioral inhibition system leads to more environmental scanning to look out for threats (Gray & McNaughton, 2000). Therefore, a high sensitivity of the behavioral inhibition system might increase attention towards salient or threat-related stimuli.

Reinforcement of behavior

Rewards and punishments for task performance have also been shown to influence visual attention (e.g. Robinson et al., 2012; Ji et al., 2015). Baines et al. (2011) tested this using an endogenous spatial cueing task with a 75% valid indicator cue. In this task the shape of the cue indicated if performance below a certain response time was rewarded with money or not. They found that response time decreased on rewarded trials compared to those not rewarded, irrespective of cue validity. Small et al. (2005), used a similar task, but with an 80% valid cue and a blocked design, in which the whole block of trials was either rewarded with money gain, punished with money loss or neither. They found a non-significant trend for faster response time on rewarded trials and a significant faster response time on trials with punishment (Small et al., 2005), irrespective of cue validity. Furthermore, two studies by Engelmann and colleagues found that both reward and punishment in the form of monetary gain or loss, improved detection sensitivity in a spatial cueing task (Engelman & Pessoa, 2007; Engelmann et al, 2009), indicating enhanced visual attention for both reward and punishment. However, contrary to Small et al. (2005) and Baines et al. (2011), these studies found no effect of incentive on response time, but only on accuracy (Engelman & Pessoa, 2007; Engelmann et al, 2009). Such differences might be due to differences in instructions or

design of the experiment. Together, these studies seem to indicate a positive effect of monetary reward or punishment on performance on an endogenous spatial cueing task. Both orienting and reorienting attention thus seem to benefit from a reinforcement incentive.

Social motivation

In contrast to reward and punishment for oneself as motivators, social motivation refers to a type of motivator that relates to other people's outcomes. For example, if someone else is in trouble, a person might extend more effort or share more if this helps the other person. Research about the influence of social motivation on behavioral performance has led to conflicting findings (Engel, 2011; Rand et al., 2012; Au & Kwong, 2004; Crockett et al., 2014). For example, a donation to a charity that builds schools for children in poverty indicates that people care about the welfare of others. In an experimental setting people often do assign other people money when there is (almost) no cost to themselves, however it has been shown that the majority of people care more for their own monetary outcomes compared to that of others' when they have to weight their own compared to other's interests (Engel, 2011; Rand, Greene, & Nowak, 2012; Au & Kwong, 2004). This has been shown using, among other paradigms, the social value orientation (SVO) measure, in which people have to make choices to divide money between themselves and others (Au & Kwong, 2004). Most people are classified as pro-self, assigning themselves more money than the other person. It has also been found that people put less effort into a task when other people's monetary outcomes are at stake compared to one's own (Lockwood et al., 2017). For example, Lockwood et al. (2017) showed that people chose less often to exert effort on a squeezing task with a higher monetary outcome compared to a non-effort lower reward option when the beneficiary was another person compared to themselves.

Contradictory to this, other research has shown that people have altruistic tendencies when it comes to other people's outcomes (Crockett et al., 2014). This research does not concern money, but harm. Crockett et al. (2014) showed that people were willing to pay more money to avoid a random stranger from being harmed compared to what they were willing to pay for themselves to avoid harm. Another study even showed that participants learnt faster to optimally avoid harm in the form of a painful shock to others, compared to learning to avoid this for themselves (Lengersdorff et al., 2020). This was shown in a paradigm in which people had to repeatedly choose between symbols in which one symbol was associated with the probability of receiving a painful shock 30% of the time while the other symbol had a chance of 70% of giving a non-painful shock. This type of learning was implicit, possibly indicating that pro social behavior is an automatic process. They also found that this learning pattern was correlated with empathic traits: A higher score on emotional contagion correlated with faster learning the symbol-punishment relationship when other's outcomes were at stake compared to their own. All in all, these results showed that there is a difference in social motivation when it comes to monetary gains or losses compared to physical harm.

To our knowledge not much research has been done to explain these conflicting findings, but one explanation might be that harm and money are different types of reinforcers. Monetary loss is a socially defined, learnt concept, and thus a 'secondary' reinforcer. This is different to harm, which is a biologically feared, innate, and thus a 'primary' reinforcer. Neuroimaging research shows that punishment in the form of monetary losses and punishment in the form of a shock, activate different brain areas (Delgado et al., 2011). Both punishments showed an increase in the activation of the striatum, which is often associated with processes of reward and punishment (Delgado et al., 2011), but punishment with shocks was also associated with a higher increase in the activation of the amygdala, which is often

associated with fear (Phelps & LeDoux, 2005; Delgado, 2007). It is possible that these differences in processing might underly the differences in behavior.

Additionally, empathy for the pain of others might be a cause for the altruistic findings concerning harm (Lengersdorff et al., 2020). Crockett et al. (2014) proposed that the negative affect that comes with the responsibility for others' negative outcomes, combined with the uncertainty that comes with others' responses to negative outcomes, could be a reason for our altruistic tendencies when it comes to harm. In line with this theory, empathy has been shown to be related to increased altruistic helping behavior, as shown by high empathic participants agreeing to receive a shock instead of someone else having to receive a shock, even when they could also have walked away from the situation without becoming involved (Batson et al., 1981). Additionally, it has also been shown that empathy is related to social value orientation thus indicating a link to more cooperative behavior (Declerck & Bogaert, 2008).

Focus of the research

The current study aims to research the effect of a punishment either to another person or to oneself in the form of a shock to the fingers on stimulus-driven visual attention. One of the studies on which the current research is based, is the study of Engelmann & Pessoa (2007). They showed that in a spatial cueing task, monetary incentive improved detection sensitivity on both valid and invalid trials, thus improving both orientation and reorientation. In addition, the effect of monetary incentive was more robust for invalid trials. However, since the interaction effect between incentive and cue validity was not significant, the latter finding should be considered exploratory, but still interesting and worthy of further research. The authors concluded that motivation improved stimulus-driven visual attention. However, the cue used in the experiment of Engelmann and Pessoa (2007) was not a truly stimulus-

driven cue. Even though the cue was presented in the periphery, it did have a predictive value as the cue was valid in 70% of the trials. Due to the predictive value of the cue, it can also be argued that this experiment was also measuring goal-driven attention even though attention was captured by a stimulus-driven cue. Therefore, in the current study we aim to replicate the findings using a truly stimulus driven cue, which holds no predictive value. We want to investigate if a punishment either to another person or oneself in the form of a shock to the fingers can influence stimulus-driven visual attention. Additionally, the role of social preferences, anxiety and behavioral inhibition will be examined.

The current research will attempt to fill the gaps in the literature using an exogenous spatial cueing task, performed under three different conditions. In one condition participants are asked to perform at a target level without any form of punishment, the 'safe' condition. In another condition the participant will be punished with an electrical shock to their own fingers if they do not perform at the target level, the 'shock to self' condition. In the last condition, another person will be punished with a shock to the fingers if the participant does not perform at the target level, the 'shock to other' condition. In all conditions the other participant will be present but remain anonymous. We hypothesize that stimulus driven visual attention improves in both punishment conditions compared to the safe condition.

In line with previous research (Engelmann & Pessoa, 2007; Small et al., 2005), we predict a faster response time and a higher accuracy in valid trials compared to the invalid trials. Additionally, in a condition with punishment (both other or self), response time will be faster and accuracy will be higher compared to the 'safe' condition. As no interaction effect was found between incentive and validity in the study of Engelmann and Pessoa, we expect similar effects for valid and invalid trials. Furthermore, the current research will assess the effects of trait anxiety and behavioral inhibition upon performance. As stimulus-driven

attentional control in more anxious individuals is more affected by threat compared to less anxious individuals (Eysenck et al., 2007), a punishment condition (self or other) might differentially impact performance of participants scoring high on the STAI compared to participants scoring low. However, as the literature is divided on the effects of anxiety on performance (Robinson et al., 2013), these will be exploratory questions without a hypothesis.

Furthermore, to assess the relationship between self and social motivation, social value orientation (SVO) will be measured. The SVO measure consists of a series of choices that concern money division to oneself and another person (Au & Kwong, 2004). It gives an indication of how much someone else's monetary outcomes are valued. As people with more pro-social preferences seem to care more about others' wellbeing, it seems intuitive that others' harm would also be a stronger motivator for them. Therefore, we hypothesize that people with a more pro-social social value orientation will have a faster response time and a higher accuracy in the other-punishment condition compared to people with a more pro-self social value orientation. Additionally, we predict that people with a more pro-self social value orientation will have a faster response time and a higher accuracy in the self-punishment condition compared to people with a more pro-social social value orientation.

Findings have shown that choices on monetary outcomes and harm do not always align, and people seem to value harm coming to others more than their monetary outcomes (Crockett et al., 2014; Engel, 2011; Rand et al., 2012; Au & Kwong, 2004). Therefore, it would also be interesting to compare these preferences. To make this possible, we have developed an adjusted SVO measure, which asks people to make a series of choices about the chance of avoiding a shock to themselves and to others, instead of dividing money. Appendix A describes the full scale and instructions that were given. However, as this is not a

recognized, validated scale, we should be careful with the interpretation of the results that are obtained. We hypothesize that people with a more pro-social social value orientation on the shock (SVO-shock) measure will have a faster response time and a higher accuracy in the other-punishment condition compared to people with a more pro-self SVO-shock measure score. Additionally, we predict a positive correlation between SVO scores and SVO-shock scores. Moreover, we expect that the scores on the SVO-shock measure will be higher (more pro-social) compared to those on the regular SVO measure.

Methods

Participants

The number of participants was based on earlier studies (Engelman & Pessoa, 2007). 50 dyads were recruited for the study. Two participants were excluded because of technical issues leading to a total number of 48 dyads (37 female, $Mdn_{age} = 19$) to be included. They were recruited through SONA from Leiden University and were between 18 and 34 years old. Furthermore, participants had normal or corrected-to-normal vision, no medical equipment, and no history of psychiatric, neurological, or cardiovascular diseases. All participants read an information letter before the start of the experiment, after which they provided informed consent. The study was approved by the Leiden social sciences ethics committee.

Stimuli and Apparatus

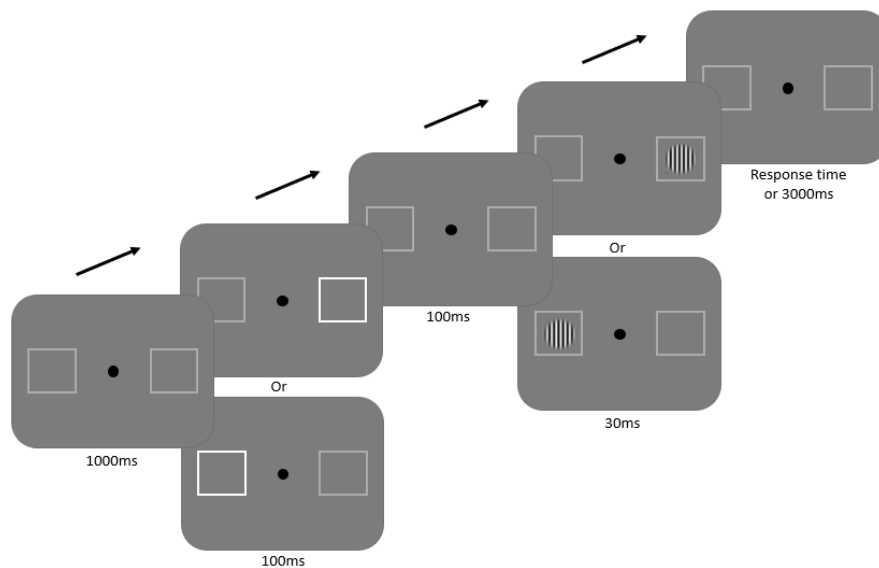
All tasks and questionnaires were presented on a Windows computer (24 inch) in one of the research labs of Leiden University. The experiment was programmed in OpenSesame (version 3.8, Mathôt et al., 2012) and the questionnaire was designed in Qualtrics (Qualtrics, Provo, UT). Furthermore, the electrical shocks were administered using the Digitimer constant current stimulator DS7A (www.digitimer.com) and standard Ag/AgCl electrodes.

During the spatial cueing task pupil dilation was measured with the Tobii eye tracker pro, as a measure of emotional arousal (Henderson et al., 2018). The data of the eye tracker has not been used in the current thesis.

Each trial of the spatial cueing task consisted of a black fixation dot (8-pixel radius) on a gray background with two placeholders with light gray outlines presented at 350 pixels (approximately 10 cm) to the left or right of the fixation dot, which was presented for 1000ms. Then the cue – the outline turning white – was presented for 100ms. After a delay of 100ms the target stimulus was presented in one of the placeholders for 30ms. The target was a horizontally or vertically oriented Gabor patch (281x279 pixels). The participant had to respond by pressing the ‘n’ for horizontal target with their index finger or the ‘m’ key for vertical targets with his/her middle finger. The next trial started after a response was given or after 3000ms had passed. During the practice blocks the fixation dot turned red on incorrect trials. Figure 1 depicts the trial order graphically.

Figure 1

Trial outline



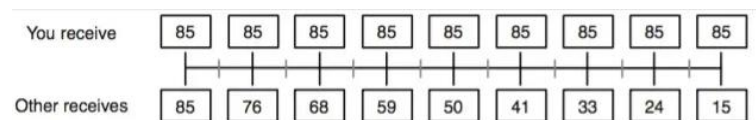
Note. The figure represents the order of the trails in the spatial cueing task. At first a fixation screen is presented for 1000ms. After this the cue, an outline of one of the boxes turning white, is presented for 100ms. Then there is a delay of 100ms before the target is presented for 30ms. Then a fixation screen is presented until either a response is given or 3000ms have passed.

To measure people's social value orientation participants filled in the SVO slider measure (Murphy et al., 2011), in which people have to divide money between themselves and 'the other'. An example question can be seen in Figure 2. This measure was part of the Qualtrics survey that participants filled in after the experiment. Furthermore, to measure if there is a difference between social value orientation when money or potential harm is involved, we have created a new questionnaire based on the SVO slider measure. In this we have changed the questions so people have to divide the chances of avoiding a shock instead of dividing money, see Figure 3 for an example question. For the complete details of this new questionnaire, see Appendix A. Additionally, participants filled in the state trait anxiety index

form Y2 (STAI), the behavioral inhibition scale (BIS) and the Toronto empathy questionnaire (TEQ). Form Y2 of the STAI measures trait anxiety, participants were instructed to fill in answers in accordance with how they generally feel. An example question of the STAI is “I feel nervous and restless” (Spielberger et al., 1983; Kendall et al., 1976). A higher score on this measure indicates a more anxious personality. The BIS aims to measure a person’s motivation to avoid negative outcomes using questions like “Criticism or scolding hurts me quite a bit.” (Carver & White, 1994). A higher score on this measure indicates a higher sensitivity to punishment. An example question of the TEQ is: “When someone else is feeling excited, I tend to get excited too.” (Spreng et al., 2009). A higher score on this measure indicates a more empathic personality.

Figure 2

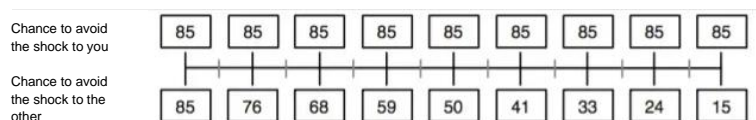
Example question SVO slider measure



Note. Participants had to indicate how they would divide the money between them and ‘the other’, thereby choosing a specific combination of two amounts of money on the slider measure.

Figure 3

Example question SVO-shocks



Note. Participants had to indicate how they would divide the chance of avoiding a shock between them and ‘the other’, thereby choosing a specific combination of two percentages on the slider measure.

Procedure

For this experiment, two participants were needed at the same time, one of which was assigned the role of the 'performer' and the other of the 'receiver'. These roles were randomly decided, unless one of the participants already knew the hypothesis, then they were assigned the role of receiver.

The performer was always scheduled to arrive first at the lab and was led to the experiment room. After signing the informed consent, they were attached to the electrodes and the shock calibration was executed to make sure that the shocks during the experiment were unpleasant but non-painful. The shocks were administered to the non-dominant hand. They had a duration of 200ms with 50Hz pulses that take 250 μ s. The starting point was 1.2 mA and after each shock two questions were verbally asked: 1) Rate on a 5 point scale how unpleasant the shock was (1 = *not unpleasant at all*; 2 = *mildly unpleasant*; 3 = *annoying*; 4 = *unpleasant*; 5 = *very unpleasant*). 2) Was the shock painful? (*yes/no*). If the first question was answered below 5 and the second question was answered with no, the stimulation was adjusted upwards. If the second question was answered with yes, the simulation was always adjusted downwards. If the second question was answered with no, and the first is answered with 5 (= very unpleasant) on two consecutive trials, the procedure was stopped and that level of mA was used for the shocks during the experiment. If the stimulation would have reached 10 mA and the participant still did not think the shock was painful and unpleasant the experiment was completed with shocks of 10 mA, however, in practice this did not happen to any of the participants. Subsequently, participants adjusted the chinrest to a comfortable height. Then they were asked to put on mufflers, so they would not hear the other participant.

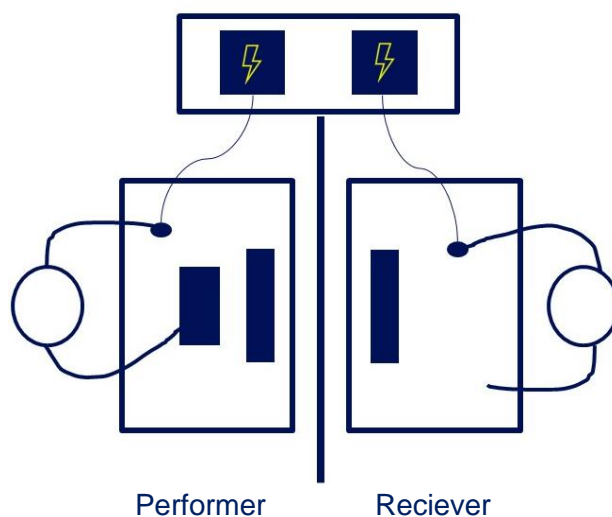
After this, the receiver would be picked up by one of the researchers and brought to the laboratory, see Figure 4 for the room set up. After signing the informed consent, the

shock calibration for the receiver took place. The receiver had a screen in front of them which they were verbally instructed to watch the experiment on. After this the experiment started.

First the eye calibration for the eye tracker took place and then instructions for the experiment were shown.

Figure 4

Experiment room setup



Note. The experimental set-up: participants remained mutually anonymous through a screen separating them from each other's view.

All performers were instructed to perform the spatial cueing task as fast and accurately as possible. The performers were asked to keep their eyes on the fixation dot in the middle of the screen. First, they completed a practice phase of four blocks with 32 trials each. They were instructed to indicate if the target was horizontally or vertically presented by pressing the n or m key. Before the targets were presented there was a cue presented on the left or right of the fixation dot. Participants were told to ignore this cue. In half of the trials the cue was in the same place as the target (valid) and the other half it was not (invalid). Furthermore, half of the trials were horizontally oriented and the other half vertically. During

practice, the fixation dot turned red when a mistake was made. Additionally, information about response time and accuracy was provided after each block. After practice, participants had a training block of 32 trials in which their average response time was determined. This response time plus 50ms was used as the limit under which the participants had to perform to not receive a shock, to either themselves or the other.

The experiment consisted of four blocks that contained 16 trials for each condition. The order of the conditions was counterbalanced between participants. Before the start of each condition, participants were informed that their response time had to be below a certain response time and their accuracy above 75% otherwise it would be followed by the punishment of the condition they were in. In the ‘shock to other’ condition, it would be followed by a shock to the other, in the ‘shock to self’ condition, it would be followed by a shock to the self and in the ‘safe’ condition it would not have any consequences. Participants received feedback after each block, consisting of the average response time and accuracy. Furthermore, all parties were informed if the performer, the receiver or no-one would receive a shock.

If a shock was given to the performer the following questions were presented on the screen: ‘Performer, how unpleasant was the shock to you?’. Participants answered on a 5-point scale (*1 = Not unpleasant at all, 3 = Neutral, 5 = Very unpleasant*). Then, whether a shock was given or not, another question had to be answered on a 5-point scale (*1 = Not afraid at all, 3 = Neutral, 5 = Very much afraid*) by the participants: ‘Performer, how afraid were you for yourself to receive the shock during this block?’ In the ‘threat to other condition’ whether a shock was given or not, the following question was answered on a 5-point scale (*1 = Not afraid at all, 3 = Neutral, 5 = Very much afraid*) by the performer: ‘Performer, how afraid were you for the Receiver to receive the shock during this block?’

Unfortunately, due to technical issues these responses have not been logged correctly and therefore could not be used in the analyses.

After the spatial cueing task, first the receiver and then the performer were escorted out of the experiment room to ensure mutual anonymity. Then the performer was asked to fill in the SVO, SVO-shock, BIS, STAI and TEQ questionnaires and some demographics in a cubicle.

Results

All analyses have been performed in R (R Core Team, 2021), with the exception of Cronbach's alpha which has been calculated in SPSS version 27 (IBM Corp, 2020). The multilevel regression models were estimated using the R package lme4 (Bates et al., 2014).

Response time

For the analysis of the response time, incorrect responses (10 %) and responses below 50ms (1.2%) were removed. Table 1 reports response time per punishment condition (shock to self/shock to other/safe) and per trial type (valid/invalid). The spread of the response time per punishment condition and trial type is depicted in Figure 5. For the analysis two dummy variables were created to compare the 'shock to other' and the 'shock to self' conditions to the 'safe' condition.

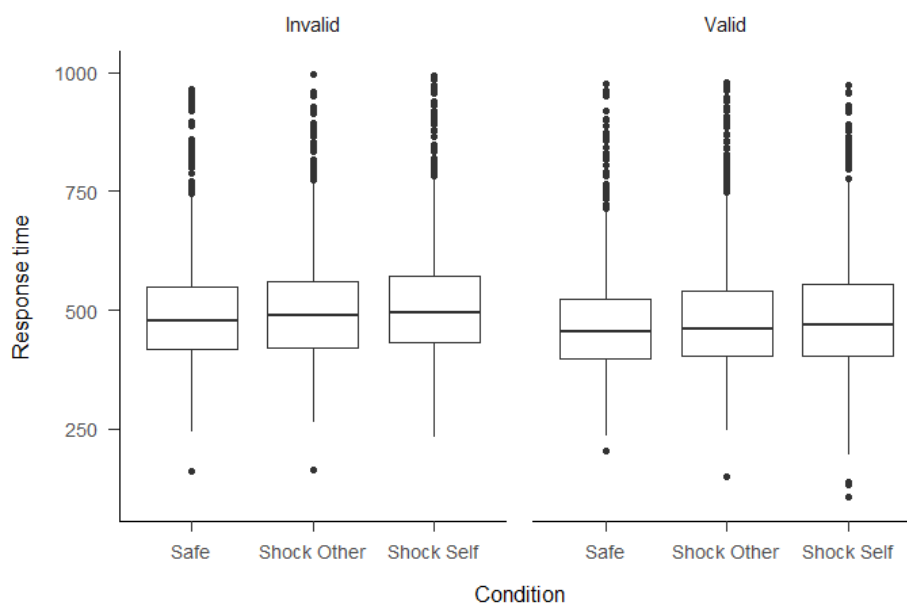
Table 1

Percentage of correct responses and average response time per punishment condition and trial type

Variable	Punishment condition and trial type					
	Safe		Shock to other		Shock to self	
	Valid	Invalid	Valid	Invalid	Valid	Invalid
Accuracy (%)	90.42	91.67	90.37	91.66	89.98	88.44
Response time (ms)	474	501	491	513	495	521
<i>SD</i> (ms)	122	147	145	175	157	149

Figure 5

Boxplot on response time per punishment and trial type.



Model 0: No predictors

In the following multilevel analyses the dependent variable was response time, all models only included a random intercept. First, we fitted a model with no predictors (Model 0) to assess the variation in the data. Calculating the intraclass correlation, based on the within and between person variance in the model ($\sigma^2_e = 4507$, $\sigma^2_u = 18217$), we find that the average correlation for any pair of responses from the same individual is quite high (ICC = 0.802). An overview of Model 0 till Model 4 including their effect size (R^2 and f^2 : Lorah, 2018) can be found in Table 2.

Table 2

Overview of the multilevel models on response time

Variable	Model 0	Model 1***	Model 2	Model 3	Model 4**
Intercept	497.920*** (9.800)	473.130*** (10.116)	472.396*** (10.319)	473.196*** (10.043)	473.137*** (10.104)
‘shock to other’ condition		16.277*** (3.530)	18.606*** (4.991)	16.303*** (3.529)	16.251 *** (3.527)
‘shock to self’ condition		20.442*** (3.552)	20.299*** (5.014)	20.453*** (3.552)	20.424*** (3.549)
Validity		25.347*** (2.894)	26.811*** (4.984)	25.330*** (2.893)	25.351*** (2.892)
Validity*other			-4.659 (7.056)		
Validity*self			0.306 (7.102)		

SVO				0.443	
				(0.781)	
SVO * other				0.450	
				(0.276)	
SVO * self				0.199	
				(0.278)	
SVO-shocks					-1.012
					(1.008)
SVO-shocks *					1.265***
other					(0.357)
SVO-shocks *					0.964**
self					(0.362)
σ_e	18217	17978	17977	17973	17950
σ_u	4507	4512	4513	4441	4501
AIC	108835.3	108728.5	108731.9	108731.1	108720.8
BIC	108856.4	108770.9	108788.4	108794.7	108784.3
Log-likelihood	-54414.6	-54358.3	-54358.0	-54356.6	-54351.4
R ²	-	.010	.010	.014	.012
f ²	-	.010	.010	.014	.012

Note. All regression weights with their standard errors are reported, additionally the model parameters are reported at the bottom of the table. The significance of model 1 was compared to model 0, while all other models were compared to model 1. *** $p < .001$, ** $p < .01$, * $p < .05$.

Model 1: Validity and punishment

A first model only included the main effects of the trial type and punishment conditions. For the punishment conditions two dummy variables were used to compare the safe condition to both punishment conditions. We found that this model explains the data better than the null model ($\chi^2(3) = 112.71, p < .001$). The main effects for the ‘shock to other’ ($b = 16.277, SE = 3.530, t(8542.4) = 4.612, p < .001$) and ‘shock to self’ ($b = 20.442, SE = 3.552, t(8542.4) = 5.755, p < .001$) compared to the safe condition are both significant. This indicates that across trial types, participants were, on average 16ms slower in the ‘shock to other’ and 20ms in the ‘shock to self’ conditions compared to the ‘safe’ condition. The main effect of validity ($b = 25.347, SE = 2.894, t(8542.0) = 8.759, p < .001$) is also significant. These results indicate that across punishment conditions subjects are on average 25ms slower to respond in the invalid trials compared to the valid trials.

Model 2: Validity and punishment interaction

In a second model (Model 2) the punishment condition dummy variables’ interaction with validity was added, but this did not lead to a better fit of the data ($\chi^2(2) = 0.618, p = .734$). The main effects of the ‘shock to other’ ($b = 18.606, SE = 4.992, t(8542.2) = 3.728, p < .001$), ‘shock to self’ ($b = 20.299, SE = 5.014, t(8542.4) = 4.048, p < .001$) and validity ($b = 26.811, SE = 4.984, t(8542.0) = 5.38, p < .001$) remained significant, while both the interaction effects were not statistically significant (Other*Validity: $b = -4.6599, SE = 7.056, t(8542.0) = -0.660, p = .508$; Self*Validity: $b = 0.305, SE = 7.056, t(8542.1) = 0.043, p = .966$). Therefore, the effect of validity did not differ per condition, as there was no significant interaction effect.

To test the effects found by Engelmann and Pessoa (2007) when they ran the models separately for valid and invalid trials, we also ran separate models. However, we found that both invalid (Other: $b = 13.939, SE = 5.311, t(4235.5) = 2.625, p = .009, CI = [3.528,$

24.350]; Self: $b = 20.563$, $SE = 5.354$, $t(4235.3) = 3.840$, $p < .001$, $CI = [10.066, 31.060]$) and valid trials (Other: $b = 18.585$, $SE = 4.657$, $t(4235.4) = 3.991$, $p < .001$, $CI = [9.456, 27.715]$]; Self: $b = 20.346$, $SE = 4.679$, $t(4235.6) = 4.348$, $p < .001$, $CI = [11.174, 29.519]$) were affected by the punishment conditions main effect and their confidence intervals overlapped, indicating no differential effect on orientation or reorientation, in line with the absence of an interaction effect.

Model 3: Social value orientation

A third model (Model 3) included all main effects and the interaction of social value orientation with the punishment condition dummy variables. Social value orientation was centered to make the model values more interpretable. However, this model did not fit the data better than Model 1 ($\chi^2(3) = 3.404$, $p = .333$), indicating no added value of the main ($b = 0.443$, $SE = 0.781$, $t(52.1) = 0.567$, $p = .573$) or interaction effects (Other*SVO: $b = 0.450$, $SE = 0.276$, $t(8542.2) = 1.631$, $p = .103$; Self*SVO: $b = 0.199$, $SE = 0.278$, $t(8542.2) = 0.716$, $p = .474$) of social value orientation in explaining response time.

Accuracy

For the analyses on accuracy, all responses below 50ms (1.2%) and above 3000ms (2.7%, max trial time) were removed. Table 1 shows the percentage correct per punishment condition and trial type. Using a logistic multilevel model, we tried out similar models to the response time models above. We find that none of the models are significantly better than the random intercepts model (Model 0 compared to: Model 1, $\chi^2(3) = 3.209$, $p = .361$; Model 2, $\chi^2(5) = 7.718$, $p = .173$; Model 3, $\chi^2(6) = 4.087$, $p = .665$). Indicating no effect of validity, punishment condition, social value orientation, nor any interaction effects on accuracy.

Descriptives on the SVO- shock measure

As the research made use of a new questionnaire, some of the descriptive statistics of this questionnaire will first be reported, before using it in any analysis. First of all, coding all

questions from most pro-social to least pro-social, Cronbach's alpha was quite poor ($\alpha = 0.539$, $CI = [0.332, 0.699]$). Second, using a Pearson's correlation test comparing the original SVO questionnaire to the shock SVO questionnaire, we can see that there is a significant moderate positive correlation between the two variables ($r = .402$, $t(50) = 3.108$, $p = .003$), see Figure 6C. This indicates that when a more pro-social person on the SVO measure is more likely to respond pro-socially on the SVO-shock measure as well. Graphically depicting the distribution of the total money and shock-avoidance division separately for oneself and the other, both seem to have a positive correlation, see Figure 6A and B. When performing a paired t-test we find that on average, people have a higher SVO angle (are more pro-social) when it comes to dividing the chance of avoiding shocks than when it comes to dividing money ($M_{\text{money}} = 31.779$, $SD_{\text{money}} = 12.410$, $M_{\text{shocks}} = 38.796$, $SD_{\text{shocks}} = 10.329$, $M_{\text{diff}} = -7.017$, $t(50) = -4.032$, $p < .001$, $CI = [-10.51, -3.523]$).

Figure 6. Scatterplots comparing the original SVO to the SVO-shock measure

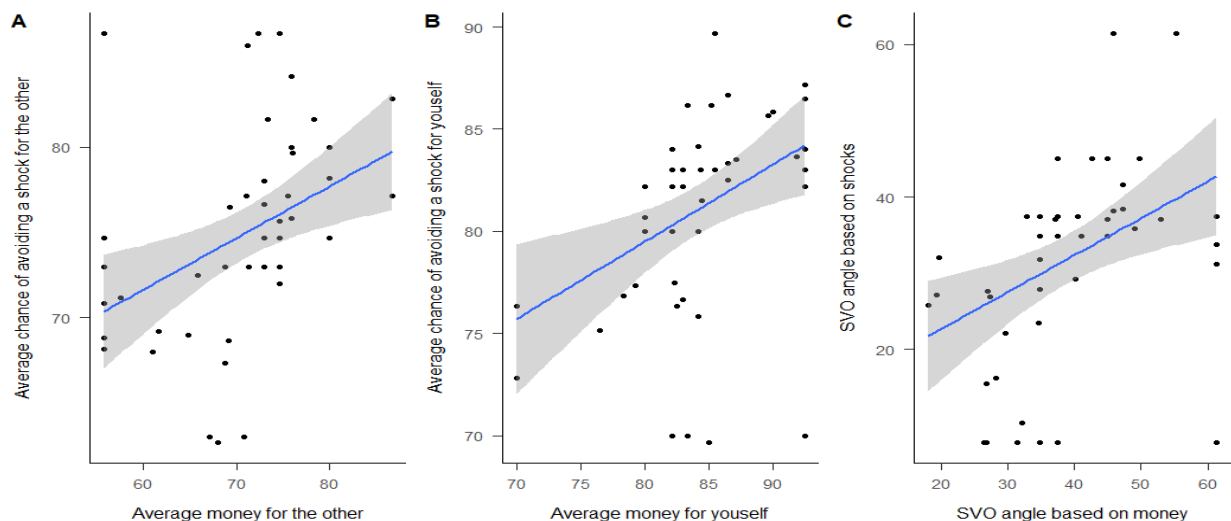


Table 3 shows the mean and standard deviation, as well as all correlations between and the Chronbach's alpha for the STAI, BIS, TEQ, SVO and SVO-shock measures. We found a low, non-significant correlation between the STAI ($r = 0.086$, $p = 0.547$) and BIS ($r = 0.068$, $p = 0.520$) with the SVO-shock measure scores, indicating that both these scales are measuring a different aspect of personality than the SVO-shock measure. The TEQ had a

non-significant low correlation with both the SVO-shock measure ($r = .071, p = 0.627$) and the normal SVO measure ($r = 0.014, p = 0.923$), indicating that in this sample empathy and social value orientation were non predictive of each other.

Table 3

Multi-trait-multi-method matrix including mean and standard deviation

Measure	M	SD	1	2	3	4	5
1. SVO-shocks	38.796	10.329	.539				
2. SVO	31.779	12.410	.402**	.602			
3. TEQ	51.510	5.863	.071	.014	.798		
4. STAI	48.096	11.252	.086	-.004	-.077	.867	
5. BIS	21.865	4.092	.068	.151	.283*	.556***	.841

Note. All means and standard deviations are reported. All correlations between measures are reported. The diagonal represents the Cronbach's alpha for each of the tests in this sample. *** $p < .001$, ** $p < .01$, * $p < .05$.

Model 4: SVO-shock measure

Now that some descriptive statistics have been reported, we report on an exploratory analysis to see if the SVO-shock measure is a good predictor in the multilevel model on response time. A model similar to Model 3 was fitted, however instead of the original SVO scores the SVO-shock scores were used. This model (Model 4) included the main effects of validity, the dummy variables for the punishment conditions, the SVO-shock measure and the

interaction between the punishment dummy variables and the SVO-shock measures. The SVO-shock measure was centered to the mean so all main effects can be interpreted for a participant with an average SVO-shock score. When we tested Model 1 against Model 4, Model 4 significantly fit the data better than Model 1 ($\chi^2(3) = 13.716, p = .003$). Therefore, we interpret Model 4. We find a significant main effect of validity ($b = 25.351, t = 8.768, p < 0.001$). This indicates that, for a participant with an average SVO-shock score across conditions, response times were on average 25ms slower on an invalid trial compared to a valid trial. We find no main effect of the SVO-shock measure ($b = -1.012, t(52.2) = -1.163, p = 0.245$), indicating that more and less pro-social people have similar response times across trial type and punishment conditions. Furthermore, there is a significant effect of the dummy variable of the ‘shock to other’ ($b = 16.251, SE = 3.527, t(8542.4) = 4.608, p < .001$). Across trial type, for a participant with an average SVO-shock score, participants were, on average 16ms slower in the ‘shock to other’ condition compared to the ‘safe’ condition. A similar effect of the dummy variable of the ‘shock to self’ variable is found, as across trial type and SVO-shock scores, participants were, on average 20ms slower in the ‘shock to other’ condition compared to the ‘safe’ condition ($b = 20.424, SE = 3.549, t(8542.4) = 5.754, p < .001$). Lastly, we find both interaction effects for the SVO-shock measure and dummies for the ‘shock to other’ ($b = 1.265, SE = 0.357, t(8542.6) = 3.541, p < .001$) and the ‘shock to self’ ($b = 0.964, SE = 0.362, t(8542.5) = 2.663, p = .008$) to be significant. This indicates that a higher score on the SVO-shocks measure – therefore more pro-social – participants are on average slower to respond in the ‘shock to other’ (95 % $CI = [0.565, 1.966]$) and ‘shock to self’ compared to the ‘safe’ condition.

A last exploratory model would have included the measure of how afraid participants were to receive a shock, however due to a technical issue this variable has not been coded

correctly and could not be used for analysis. Instead the BIS and STAI scores will be used, which will both be centered around their mean in the sample.

Model 5: BIS

In model 5, the BIS scores and their interaction with the punishment conditions were added to model 4. Model 5 has a significantly better fit than model 4 ($\chi^2(3) = 13.716, p = .003$). Therefore, we interpret this model. We find that all parameters that were significant in Model 4, remain significant in Model 5. Results show a main effect of validity ($b = 25.367, SE = 2.890, t(8542.0) = 8.778, p < .001$), the ‘shock to other’ condition ($b = 16.212, SE = 3.525, t(8542.4) = 4.599, p < .001$), the ‘shock to self’ condition ($b = 20.417, SE = 3.548, t(8542.4) = 5.755, p < .001$) and an interaction effect of the SVO-shock score with the ‘shock to other’ condition ($b = 1.208, SE = 0.358, t(8542.5) = 3.375, p < .001$), and the ‘shock to self’ condition ($b = 0.923, SE = 0.362, t(8542.5) = 2.548, p = .011$). The main effect of the SVO-shock score remains non-significant ($b = -0.985, SE = 1.009, t(52.2) = -0.976, p = .333$) and the main effect of the BIS score was also non-significant ($b = -1.088, SE = 2.405, t(52.0) = -0.452, p = .652$) indicating no overall difference in response times per personality trait scores. The BIS score did, however, show a significant interaction effect with both the ‘shock to other’ ($b = 2.455, SE = 0.843, t(8542.2) = 2.913, p = .004$) and ‘shock to self’ conditions ($b = 1.675, SE = 0.848, t(8542.2) = 1.976, p = .048$). This indicates that participants who score higher on the BIS – therefore more prone to avoid punishments – are on average slower to respond in the ‘shock to other’ and the ‘shock to self’ condition compared to the ‘safe’ condition.

Model 6: STAI

In model 6, the STAI scores and their interaction with the punishment conditions were added to model 4. Model 6 has a significantly better fit than model 4 ($\chi^2(3) = 7.948, p = .047$). Therefore, we also interpret this model. We find that all parameters that were

significant in Model 4, remain significant. Results show a main effect of validity ($b = 25.354$, $SE = 2.890$, $t(8542.0) = 8.773$, $p < .001$), the ‘shock to other’ condition ($b = 16.220$, $SE = 3.525$, $t(8542.4) = 4.601$, $p < .001$), the ‘shock to self’ condition ($b = 20.411$, $SE = 3.548$, $t(8542.4) = 5.753$, $p < .001$) and an interaction effect of the SVO-shock score with the ‘shock to other’ condition ($b = 1.195$, $SE = 0.358$, $t(8542.6) = 3.336$, $p < .001$), and the ‘shock to self’ condition ($b = 0.932$, $SE = 0.363$, $t(8542.5) = 2.569$, $p = .010$). The main effect of the SVO-shock score remains non-significant ($b = -0.952$, $SE = 1.009$, $t(52.2) = -0.943$, $p = .350$) and the main effect of the STAI score was also non-significant ($b = -0.761$, $SE = 0.868$, $t(52.077) = -0.877$, $p = .384$) indicating no overall difference in response times per personality trait scores. The STAI score did show a significant interaction effect with the ‘shock to other’ condition ($b = 0.855$, $SE = 0.307$, $t(8542.3) = 2.790$, $p = .005$), but no significant interaction effect with the ‘shock to self’ condition ($b = 0.409$, $SE = 0.306$, $t(8542.2) = 1.336$, $p = .182$). This indicates that participants who score higher on the STAI – therefore more anxious – are on average slower to respond in the ‘shock to other’ condition, but no slower in the ‘shock to self’ condition, compared to the ‘safe’ condition.

Multiverse analyses

For a while now, the literature has had a higher focus on ‘researcher degrees of freedom’, which means that even if researchers are not using multiple testing to try and find a significant effect, they do make choices that might divert from the choices that others could or would have made with the same methods and data (Gelman & Loken, 2013). Even though a full multiverse analysis might be too computationally heavy for a master thesis (or many other papers for that matter), a few different analysis choices that seem equally plausible will be reported on in appendix B. No notable differences in conclusions have been found in any of the alternative analyses.

Discussion

The main purpose of this study was to examine what the effect of self or other punishment was on stimulus driven visual attention. Therefore, an exogenous spatial cueing task was used in which too slow or inaccurate performance was punished with a shock to either the participant self or another participant relative to a safe condition.

In line with previous research, we found a main effect of validity, which showed that response time was faster on valid trials compared to invalid trials (e.g. Engelmann & Pessoa, 2007; Engelmann et al., 2009). This is often explained by the costs of reorientation, in which the non-valid cue draws attention first and therefore slows orientation towards the target. Moreover, similar to Engelmann and Pessoa (2007) we found no interaction effect of punishment and validity. Additionally, as Engelmann and Pessoa (2007) found a non-significant main effect of reward and punishment for valid trials, while this effect was significant for invalid trials, therefore we also ran the models separately for valid and invalid trials. However, in line with finding no interaction effect, we find significant main effects of the punishment conditions for both valid and invalid trials. Therefore, we did not find evidence for differential motivational effects on stimulus-driven attentional orientation (valid trials) and reorientation (invalid trials).

A possible explanation for the difference between the findings on valid trials in our study compared to that of Engelmann and Pessoa is the difference in the type of spatial cueing task used. While the current research used an exogenous spatial cueing task (50% valid cue), the research of Engelmann and Pessoa (2007) used an endogenous spatial cueing task (70% valid cue) but with a sudden onset cue in the periphery, instead of a central cue. The cue in the research of Engelmann and Pessoa (2007) provided goal directed information and therefore punishment could influence goals-directed attention to possibly effect orientation and reorientation differently. However, the current research findings on stimulus

driven attention indicate that punishment does not affect stimulus driven attention differentially on orientation and reorientation trials. Alternatively, the differential findings between studies could be due to chance as no interaction effect was found in both studies.

The effect of punishment

Contradictory to our hypothesis, it was found that performance does not improve under pressure of punishment to either oneself or another. Surprisingly, results even showed that response time was slower in both (self/other) punishment conditions compared to the safe condition, irrespective of cue validity. As there were no differences in accuracy found, we cannot conclude that the slower responses are due to a speed-accuracy trade-off.

One possible explanation for the found results, might be that participants experienced higher anxiety during the blocks in which there was a punishment relative to the safe condition. Increased anxiety might have led to deteriorated performance, even though so far results in the literature are mixed, showing both deteriorated and improved task performance (Momin et al, 2020; Janelle, 2002; Murray & Janelle, 2003; Eysenck et al., 2007).

Unfortunately, we could not test differences in state anxiety between conditions due to a technical error in logging this measure. However, trait anxiety, as measured by the STAI, was used as a proxy for anxiety during the experiment. Furthermore, as the BIS aims to measure aversion to punishment and is often linked to anxiety (Gray & McNaughton, 2000) this measure was also used to model the possible negative affect in response to punishment conditions. Results showed that for higher trait anxiety scores response time slowed more compared to lower trait anxiety scores in the 'shock to other' condition relative to the safe condition. However, response times were not affected by anxiety in the 'shock to self' condition relative to the safe condition. For the BIS, it was found that a higher behavioral inhibition score resulted in a slowed response time in both the 'shock to other' and 'shock to self' condition compared to the safe condition. These interaction effects indicate that

participants scoring higher on the BIS and STAI may have experienced more anxiety or negative affect during the punishment conditions in the experiment leading to a slower response time compared to participants scoring lower on the BIS and STAI.

These findings could be interpreted in the following framework. Previous research has shown higher activation of the amygdala under threat of harm compared to monetary loss, possibly indicating fear or anxiety (Delgado et al., 2011). The results on the effect of anxiety on task performance are mixed (Momin et al, 2020; Janelle, 2002; Murray & Janelle, 2003; Eysenck et al., 2007), but Robinson et al. (2013) suggest that the effect of a threat might vary under different task loads. Under a task load that is low, anxiety can cause a competition of resources between attention to the threat and attention to the task. In the case of the current experiment, task performance was quite high (above 88% accuracy) in all conditions, possibly indicating a low task load. Additionally, stimuli with an emotional valence have generally been shown to capture attention more than neutral stimuli (Fox et al., 2001; Fox, et al., 2002). Therefore, attention might have been drawn away from the task towards the threat (e.g. the fingers on which the electrodes were applied or the screen behind which the other participant was placed), therefore leading to slower response times in both punishment conditions.

A possible alternative explanation for these differential findings in the literature would be the type of punishment used and is related to research on threat and challenges. Research in this area shows that appraising a situation as a challenge could lead to enhanced performance, while appraising a situation like a threat could lead to deteriorated performance (Gonzales-Morales & Neves, 2015). For example, Vine et al. (2013) showed that challenge appraisal was associated with improved attentional control – as indicated by a longer target focus – and improved performance on a pick and drop task. This is a task in which

participants have to pick and drop objects in specific places using a joystick. Even though it's usually used for measuring motor control, target focus is essential for optimal performance and indicative of attentional control. Extending these findings to our experiment, it could be possible that participants appraised the situation as a threat (to possibly receive a shock), while in the experiment of Engelmann and Pessoa (2007) the situation was viewed as a challenge (to not lose any money). This would be in line with the differential findings on performance, as Engelmann and Pessoa found a positive effect of punishment on detection sensitivity, while the current study finds no such positive effect on performance. However, whether the differential findings between the current study and the Engelmann and Pessoa (2007) study are due to 1) a chance finding, 2) the differences in the punishment type – monetary vs shocks, or 3) the differences in the type of spatial cueing task – exogenous vs endogenous (50% vs 70% validity), cannot be concluded yet. Research that replicates these results, directly compares the different punishment types (monetary vs shocks) and assesses threat appraisal would be needed to further investigate the found effect.

Another recommendation for future research would be to measure state anxiety during the task. This would be different from taking the STAI or BIS measures as these measures represent anxiety and behavioral inhibition as a trait, while measuring anxiety during the task would more accurately represent the state of a participant during the experiment, which can demonstrate differences between the conditions. Anxiety can be influenced by many environmental factors, for example how (un)comfortable a participant is in the research lab or the amount of sleep a participant has had (Pires et al., 2016). Therefore, a real-time questionnaire would be a better representation of the experienced anxiety during the experiment compared to a questionnaire measuring a trait. It would be even better to measure anxiety physiologically, using skin conductance or heart rate variability (Soni & Rawal,

2020), as humans are notoriously bad at self-reporting without bias (Harrison et al., 1996; Razavi, 2001).

Furthermore, it would be interesting to vary the task load in a future experiment. As described above, Robinson et al. (2013) propose that the effect of anxiety might differ by cognitive load and this could be tested by varying task difficulty within participants on a spatial cueing task. Engelmann, et al. (2009), for example, used a spatial cueing task in which the target was a black and white distorted image of a face and a distractor target that only consisted of a black and white distorted image containing no face. They varied task difficulty by increasing the extent of the distortion on the target face, however they did not report on the results of the task difficulty and its interactions with other factors. A future study could examine the effects of task load and its interaction with anxiety or fear. Additionally, it would be interesting to explore what the effect of cognitive load would be on self compared to other punishment. If the effects of distraction due to anxiety are reduced under increased task difficulty, it would be possible that response times would become approximately equal in the safe and punishment conditions.

Shock social value orientation

Pertaining to our other hypothesis, we did not find an interaction between social value orientation and punishment conditions. Therefore, we find no evidence of more pro-social people having slower (or faster) response times in either a self or other punishment condition, which is inconsistent with our predictions based on research that showed that people were willing to pay more and improved implicit learning when other punishment was at stake (Crockett et al., 2014; Lengersdorff et al., 2020). However, it is interesting to note that an interaction was found between the SVO-shock measure score and both punishment conditions. In contrast to our expectations, we found that response time was slower for pro-

social people compared to pro-self people in both the ‘self’ and ‘other’ punishment conditions compared to the safe condition. This could fit with the findings of Crockett et al. (2014) that harm aversion for others was strongly related to harm aversion for oneself, thus possibly accounting for the similar results found in the ‘self’ and ‘other’ punishment conditions. It is possible that more pro-social people experienced more anxiety in both punishment conditions. After controlling for the BIS and STAI scores, the interaction of the SVO-shock measure with the punishment conditions was still significant. This indicates that the SVO-shock measure had a predictive value even beyond the BIS and STAI scores and thus beyond a general trait measure of anxiety and behavioral inhibition. It can, however, not be ruled out that this effect is still due to anxiety or fear, as we did not have a direct measure of anxiety during the task itself. Independent of punishment aversion and trait anxiety, anxiety during the experiment could be increased by caring about the other’s (and one’s own) outcomes. More research would be needed to replicate these findings and test this possible explanation.

Unrelated to the spatial cueing task, we also replicated the finding in the literature that outcomes of other people concerning harm and money are valued differently (Crockett et al., 2014). We found that participants tended to be more pro-social when it comes to avoiding harm to others compared to how much money they give others. Additionally, in line with our hypothesis we found that the SVO and SVO-shock scores were positively correlated, indicating that people who are more pro-social on the SVO measure are also more pro-social on the SVO-shock measure.

Nonetheless, these results should be interpreted with care, as the SVO-shock measure is not (yet) a validated scale. Appendix A presents the SVO-shock measure and a discussion on the psychometric qualities of the scale. Even though the discriminative and convergent validity of the SVO-shock measure seem good enough in this sample, more research should

still be done before firm conclusions can be drawn. For example, it is still unknown if the test-retest reliability is sufficient and thus if it reflects a stable trait. Therefore, it is important that the scale is validated and results are replicated. Another limitation of the study is generalizability, as the study was performed in the lab and the spatial cueing task is quite distant from real life situations. Therefore, it is difficult to tell if these results would replicate to a real-life situation, for example in a complex traffic situation in which visual attention is crucial. Another limitation of the results is that we could not control for fear or anxiety during the experiment, as the fear measure during the experiment did not log properly due to a technical failure. Future research would be needed to address these limitations.

Conclusion

To conclude, the current study found that response time slows under pressure of punishment to either oneself or another relative to a safe condition. Furthermore, higher punishment avoidance was correlated with slower responses in both 'other' and 'self' punishment conditions compared to a 'safe' condition. A higher trait anxiety was correlated with slower responses in only the 'other' punishment condition. Visual attention does not seem to be influenced by social value orientation based on money when under threat of a punishment, but it might be attenuated by social value orientation based on shock avoidance, as response time becomes slower in both punishment conditions. To conclude, we found evidence of punishment attenuating visual attention resulting in slower responses overall. Therefore, rather than improvement of attentional control we found that punishment can impair stimulus-driven visual attention.

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Appendix A: Social value orientation shock scale

The social value orientation shock slider measure was presented in with the following instructions.

“Shock task

The following is a hypothetical scenario.

In this scenario, you have been paired with another person, whom we will refer to as the Other. This Other is someone you do not know and who will always remain mutually anonymous. All of your choices are completely confidential.

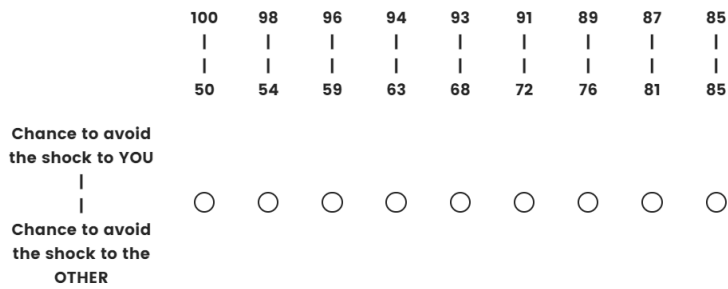
You will be making a series of decisions about how likely it is for you and for the Other to receive an electric shock. The default is that you and the Other will always receive a shock. However, you can decide to **reduce the chance of receiving the shock** to you or to the Other person.

In the example below, a person has chosen to **reduce** their own chances of receiving a shock by 50%, and to the Other person by 40%. This means that the chance of receiving a shock by that person would be 50%, while 60% for the Other.

In other words: the higher the percentage you choose, the higher chances one can avoid an electric shock.

For each of the following questions, please indicate the distribution you prefer most, by marking the respective position. You can only make one mark for each question. There are no wrong or right answers, this is all about personal preferences. As you can see, your choices would influence both your and the Other’s chances of avoiding a shock. ”

Choice 6:



Discussion on the results

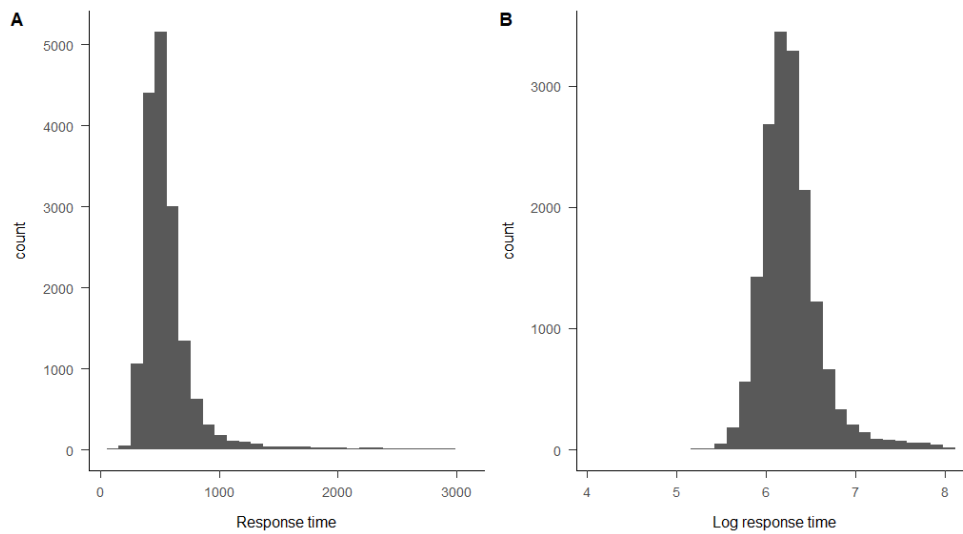
We reported on some descriptive statistics of the newly created scale, even though the internal consistency was somewhat poor, this could be explained by how the scale is built. In literature on the original SVO-slider measure, people are often put in a pro-social or pro-self category. However, the scale does not allow for this comparison from left to right as there are sometimes also competitive choices possible, in which the most pro-social choice is also the most pro-self choice. A high internal consistency using Cronbach's alpha is thus hindered by filling in the questionnaire with all pro-self choices, even though this is likely to happen and still a valid answering pattern. A similar problem would occur if the questions were scored on how 'pro-self' they are, as a pro-social answering pattern wouldn't be considered internally consistent ($\alpha = 0.506$). For the regular monetary SVO measure the internal consistency is only slightly higher. We did find quite a large correlation between the original SVO and SVO-shock measure, indicating that more pro-social people when it comes to money division are also more pro-social when it comes to shock avoidance. This finding indicates that the SVO-shock measure correlates with related concepts and thus possibly measures what it aims to measure. The low correlation with the STAI and the BIS is good for discriminative validation, as this indicates that the scale is not measuring anxiety or motivation to avoid negative outcomes. The low correlation of the SVO-shock measure with the TEQ-score is

somewhat surprising, as empathy and pro-social behavior have been shown to be related to each other in previous research (Declerck & Bogaert, 2008). However, we also find a low correlation between the TEQ and the monetary SVO measure. Future research could focus on understandability of the scale and see if any adjustments are needed to improve upon this. It is also important to assess test-retest reliability to see if the preferences in the questionnaire can be said to reflect a stable personality trait.

Appendix B: Multiverse analyses

For a while now, the literature has had a higher focus on ‘researcher degrees of freedom’, which means that even if researchers are not using multiple testing to try and find a significant effect, they do make choices that might divert from the choices that others could or would have made with the same methods and data (Gelman & Loken, 2013). Even though a full multiverse analysis might be too computationally heavy for a master thesis (or many other papers for that matter), a few different analysis choices that seem equally plausible will be reported on.

First of all, above we made the choice to not log transform the data as multilevel modeling is robust against violation of the normality assumption when there is enough data. However, this choice is also arbitrary and both sides could be argued for. Log transformation leads to a more normal distribution of response time, see Figure 7. Therefore, we also report our models with a log transformation, see table 5. Both analyses lead to similar results with only one change in significance of the models or the predictors, which is that the main effect of the punishment to self condition is no longer significant. However, after centering the SVO variable to its mean, which ensures that all values in the model are in a realistic range of the sample, this effect is significant again.

Figure 7*Histogram of response time*

Note. Distribution of response time before (A) and after (B) log transformation.

Table 5*Overview of multilevel models on log transformed response time*

	Model 0	Model 1 ^{0***}	Model 2 ¹	Model 3 ¹	Model 4 ^{1**}
Intercept	6.175 *** (0.019)	6.129 *** (0.019)	6.129 *** (0.019)	6.111 *** (0.052)	6.201 *** (0.077)
Punishment condition other		0.027 *** (0.006)	0.030 *** (0.008)	0.001 (0.015)	-0.050* (0.023)
Punishment condition self		0.036 *** (0.006)	0.032 *** (0.008)	0.030 (0.015)	-0.019 (0.023)
Validity		0.051 *** (0.004)	0.051 *** (0.008)	0.051 *** (0.005)	0.051 *** (0.005)

Validity*other				0.007	
				(0.011)	
Validity*self				0.007	
				(0.011)	
SVO				0.0005	
				(0.001)	
SVO * other				0.0008	
				(0.0004)	
SVO * self				0.0001	
				(0.0004)	
SVO-shocks					-0.002
					(0.002)
SVO-shocks *					0.002 ***
other					(0.0006)
SVO-shocks *					0.001*
self					(0.0005)
Sigma e	0.048	0.047	0.047	0.047	0.047
Sigma u	0.017	0.017	0.017	0.017	0.017
AIC	-1542.3	-1696.5	-1694.0	-1694.4	-1705.0
BIC	-1521.1	-1654.2	-1637.5	-1630.9	-1641.5
Log-likelihood	774.1	854.3	855.0	856.2	861.5

Note. All regression weights with their standard error are reported. *** p < .001, ** p < .01, *

p < .05. ⁰ Compared to model 0, ¹ compared to model 1

Secondly, in response time experiments too fast responses are often removed, saying that this is done to remove anticipatory responses. The choice to remove fast responses is, however, somewhat arbitrary. There are papers in which responses of 120ms (Jongen & Smulders, 2007) or 150ms (Gobel & Giesbrecht, 2020) are removed. To check if our results still hold when choosing a different cut offs we ran Model 0, 1 and 4 again using these three cut offs. When using 120ms as the cutoff only three data points are removed, and we find no changes in significance. For 150ms only 2 more datapoints are removed and there are again no changes. Therefore, the found results are robust against different cut-offs of lower outlier removal.