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Treatment effect on biases in size estimation in spider phobia

Youssef Shiban[a,*], Martina B. Fruth[b], Paul Pauli[b], Max Kinateder[c], Jonas Reichenberger[a], Andreas Mühlberger[a]

[a] Department of Psychology (Clinical Psychology and Psychotherapy), University of Regensburg, Germany
[b] Department of Psychology (Biological Psychology, Clinical Psychology, and Psychotherapy), University of Würzburg, Germany
[c] Department of Cognitive, Linguistic & Psychological Sciences, Brown University, United States

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ABSTRACT

Background: The current study investigates biases in size estimations made by spider-phobic and healthy participants before and after treatment.
Method: Forty-one spider-phobic and 20 healthy participants received virtual reality (VR) exposure treatment and were then asked to rate the size of a real spider immediately before and, on average, 15 days after the treatment. During the VR exposure treatment skin conductance response was assessed.
Results: Prior to the treatment, both groups tended to overestimate the size of the spider, but this size estimation bias was significantly larger in the phobic group than in the control group. The VR exposure treatment reduced this bias, which was reflected in a significantly smaller size rating post treatment. However, the size estimation bias was unrelated to the skin conductance response.
Conclusion: Our results confirm the hypothesis that size estimation by spider-phobic patients is biased. This bias is not stable over time and can be decreased with adequate treatment.

Numerous studies have demonstrated an increased attention to threatening stimuli, in both phobic and non-phobic participants (Cisler, Ries, & Widner, 2007; Mogg & Bradley, 2006; Öhman, Flykt, & Esteves, 2001, p. 38; Watts, McKenna, Sharrock, & Trezise, 1986). Attentional biases have been observed during different stages of perception, e.g. quick attention engagement (Mogg & Bradley, 2006), slow disengagement of attention (Fox, Russo, Bowles, & Dutton, 2001; Fox, Russo, & Dutton, 2002) and inability to ignore distractors (Gerdes, Alpers, & Pauli, 2008; Okon-Singer, Alyagon, Kofman, Tzelgov, & Henik, 2011). Other well-documented biases include consequence-expectancy bias and an encounter-expectancy bias. According to the former, spider-phobic patients – when compared to a non-phobic population – tend to overestimate the danger when they expect a possible encounter with a spider (Riskind, Moore, & Bowley, 1995; Teachman & Woody, 2003). The latter bias consists of the tendency of fearful individuals to overestimate the chance of encountering a feared object (Aue et al., 2015; Aue, Hoeppli et al., 2013; Davey & Dixon, 1996; de Jong & Muris, 2002; Mühlberger, Wiedemann, Herrmann, & Pauli, 2006). A recent experiment by Aue, Guex, et al. (2013) showed that the attentional bias for phobic cues cannot be modulated by expectancy in phobic or in non-phobic participants, whereas the reaction time for non-threatening cues can be influenced by expectancy. Furthermore, Aue, Hoeppli et al. (2013) point to the possibility that attention can modulate expectation. They demonstrated that the time spent looking at a phobic stimulus correlated positively with the expectancy to encounter that stimulus in phobic participants, whereas it was correlated negatively in non-phobic participants.

There are strong indications that fear biases self-reported estimates of visual information that is related to a fear-inducing stimulus or context. For example, Stefanucci, Proffitt, Clore, and Parekh (2008) asked participants to stand on a skateboard (experimental group) or on a stable wooden box (control group) on top of a hill. Their task was to estimate the steepness of the hill. In a second study, participants estimated the height and size of a pool. The pool was either empty (control group) or contained a bed of nails (experimental group), and participants were instructed to imagine falling into the pool (Stefanucci, Gagnon, Tompkins, & Bullock, 2012). The fear induction in the experimental group led to exaggerated estimates of the slope's steepness (study 1) and the height and the size of the bed of nails (study 2). Further three studies measured the estimation bias under fear in patients with phobias. In the first study, participants with acrophobia were asked to estimate the height of a balcony while they were standing on a high building themselves. Highly fearful participants estimated the balcony to be higher than the less fearful participants did. However, the less fearful partici-

* Corresponding author.
E-mail address: Youssef.Shiban@psychologie.uni-regensburg.de (Y. Shiban).

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pants also overestimated the height (Teachman, Stefanucci, Clerkin, Cody, & Proffitt, 2008). In the second study the same authors intensified the effect by inducing fear (asking the participants to imagine falling over the balcony) and were successful in increasing the estimation bias (Clerkin, Cody, Stefanucci, Proffitt, & Teachman, 2009). Vasey et al. (2012) asked spider-phobic participants to estimate the size of a spider and concluded that size estimation biases correlate with the level of fear of spiders. It is important to take into account that the authors of the listed studies only collected subjective data after the post-treatment Behavioral Avoidance Test was finished, i.e. the spider was no longer visible to the participant. Furthermore, they did not measure pre-treatment bias and therefore were not able to observe any changes due to treatment. The authors also did not compare the bias of spider-phobic participants with that of non-fearful participants.

In the present study, we intend to replicate the findings of the size estimation bias in specific phobias from Vasey et al. (2012) by testing participants with arachnophobia. We also aim to validate the size estimation bias by comparing the spider-phobic test group to a non-fearful control group. Additionally, we anticipate expanding the findings by analyzing changes in the bias caused by exposure treatment. Our main hypothesis states that both spider-phobic patients and healthy participants overestimate the size of a living spider. Therefore, we predict that there is a size estimation bias in both groups, as Teachman et al. (2008) also found an estimation bias in less fearful participants. However, we hypothesize that the size estimation bias in phobic patients is significantly higher than in healthy participants prior to the exposure treatment. Our third hypothesis states that the size estimation bias in the phobic group decreases after exposure treatment. Furthermore, we assessed the electrodermal activity during the exposure treatment in our current study in order to test our hypothesis that the higher the physiological arousal, the greater the size estimation bias in the phobic group.

1. Method

1.1. Participants

Sixty-one participants were recruited for the present study. The sample consisted of a phobic group and a non-phobic control group. For demographics and baseline differences between the groups, see Table 1.

1.1.1. Phobic group

The phobic group consisted of 41 participants (38 female, $M = 22.7$ years, $SD = 3.92$ years) selected from a larger virtual reality (VR) treatment study, who were willing to participate (see Shiban, Schelhorn, Pauli, & Mühlberger, 2015). They were recruited through advertisements in local newspapers and on the internet, as well as through the distribution of flyers. Exclusion criteria were: age under 18 years, current pregnancy, current intake of psychopharmacological medication, current involvement in psychiatric or psycho-therapeutic treatment, cardiovascular or neurological diseases, known occurrence of sickness during 3D-simulations and low fear of spiders (scoring less than 70 on a scale ranging from 0 to 100, with 0 being no fear and 100 being the worst fear possible). The participants reported their exclusion criteria during a telephone screening. In addition, participants had to fulfill the DSM-IV criteria for spider phobia (APA, 1994), as assessed at the first meeting with a structured clinical interview SCID I (Wittchen, Zaudig, & Fydrich, 1997). Participants in the phobic group were randomly assigned to a VR treatment in one of four different modalities (single context, single stimulus: $n = 8$; multiple stimulus, single context: $n = 10$; single stimulus, multiple context: $n = 14$; multiple stimulus, multiple context: $n = 9$). Participants of all modalities were grouped and referred to as the phobic group when measuring the effects of the treatment.

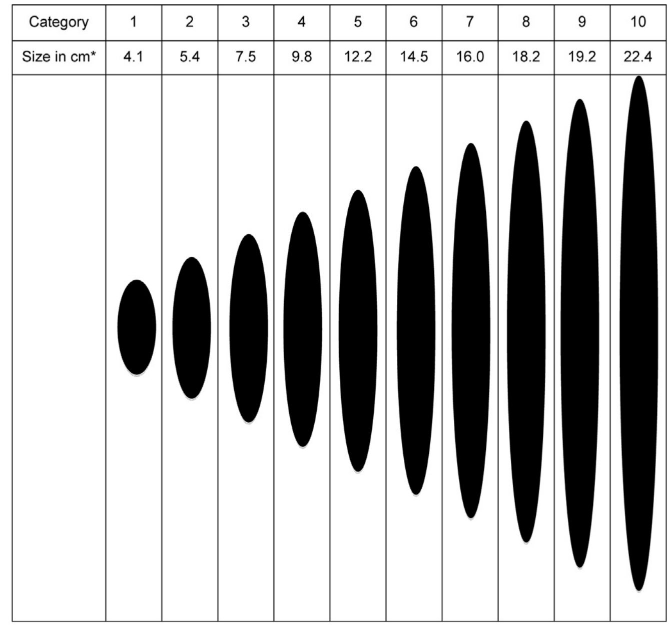

Fig. 1. Spider size category form. The size of the real spider corresponds to category 3 and bias was calculated as the difference between category 3 and the one pointed at by the participant. *The size in cm was not part of the sheet given to the participants and is given here only for clarity.

1.1.2. Control group

Twenty healthy participants (20 female, $M = 25.2$ years, $SD = 6.09$ years) were recruited in order to measure the bias in the non-phobic group. Exclusion criteria for control group were male gender (in order to match the phobic group). In addition, participants who reported high fear of spiders – estimated by self-reporting a fear of spiders of more than 70 on a scale ranging from 0 to 100, with 0 being no fear and 100 being the worst fear possible – were excluded from the experiment. The study was approved by the ethics committee of the psychological department at the University of Würzburg.

1.2. Stimulus material

A female spider of the genus *Grammostola rosea*, about 7.5 cm in size (including legs and body), was positioned on the table-track of the Behavioral Avoidance Test in a transparent box (7 cm × 14 cm × 10 cm) 3 m away from the participants' chair (described in Section 1.3). The real size of the spider corresponded to category number 3 on Fig. 1.

1.3. Measures

Behavioral Avoidance Test (BAT): The device consisted of a crank and wooden guide rails. With the BAT, a sliding plate can be moved over a distance of 3 m (see Fig. 2, similar to Garcia-Palacios, Hoffman, Carlin, Furness, & Botella, 2002). Participants were instructed to sit on a chair as the experimenter placed the box containing the spider, covered with a piece of fabric, on the sliding plate. Then, the spider-box was uncovered and the actual fear experienced at that moment was reported by the participants (on a scale of 0–10, with 0: no fear and 10: the worst fear possible). The participants were then asked to estimate the size of the spider by comparing it to the size category form (see Fig. 1) and pointing