What You See is Not What You Get: The Influence of Approach and Escape Motivation on Visual Perception and Behavior in Spider-fearful Individuals

by

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Abstract

The present study examined the influence of approach and escape motivation on visual perception, and whether these perceptions affect action responses in a direction congruent with these respective motivations, by comparing thirsty and quenched individuals (Experiment 1) as well as spider-fearful and spider-tolerant individuals (Experiment 2). In Experiment 1, thirsty individuals perceived a water bottle to be closer than quenched individuals. The closer the water bottle was perceived, the shorter the distance that participants stepped away from the water bottle relative to their baseline. In Experiment 2, spider-fearful individuals perceived a stimulus that evoked threat (tarantula) as physically closer and bigger than stimuli that evoked disgust or a neutral affective signal compared to spider-tolerant individuals. As participants endorsed higher degrees of spider-related fear (on the FSQ and SPQ) and perceived greater levels of threat, they perceived the contained tarantula as closer in egocentric distance and longer in size. The closer and bigger the tarantula was perceived by participants, the longer the distance that they stepped away from it relative to their baseline. This study is the first to demonstrate a linear association between biased visual perception and approach/escape behavior, in which the degree of the bias predicts the extent of the relevant action response. These results suggest that visual perception and action responses are not mutually exclusive processes but rather are interconnected psychological events, which can be partially predicted relationally. Potential implications of this key finding are discussed.

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I. Introduction

For centuries, human perception was viewed as a passive process involving little complexity (Bruner & Goodman, 1947). The prevailing view was that individuals perceiving incoming sensory stimuli merely acted as recording instruments, unaffected by psychological factors. However, as research methodologies in psychology grew more and more sophisticated in the first half of the 20th century, these views became increasingly challenged. As Louis Thurstone (1944) argued, "In these days when we insist so frequently on the interdependence of all aspects of personality, it would be difficult to maintain that any of these functions, such as perception, is isolated from the rest of the dynamical system that constitutes the person" (p. 47). These and other similar views consequently spurred a new movement in the literature to explore how the process of perception is influenced by psychological factors (from both internal and external pressures) and vice versa.

Overview

The structure of this Introduction will follow a historical progression of the literature exploring the influence of psychological factors on visual perception. When the literature was in its infancy, external influences on perception (viz., conformity effects) were primarily emphasized. As the literature evolved, however, internal influences on perception (e.g., motivation, desire, and needs of the organism) began to receive more attention. Accordingly, the Introduction will begin by briefly reviewing two classic empirical studies on the role of conformity in making perceptual judgments. What follows is a review of the literature on internal states and their influence on visual perception, criticisms of this literature that led to its

dormancy, and its recent resurgence. The Introduction will conclude by discussing the present study along with a brief review of specific phobia. The purpose and hypothesized results of the present study will also be discussed.

Conformity Influences on Visual Perception

A series of early studies investigated the role of conformity in making perceptual judgments. In one classic experiment, Sherif (1936) examined the influence of group conformity on the autokinetic effect—the illusory phenomenon in which individuals shown a stationary point of light in a uniformly dark room report to see it move, which is said to occur because there lacks a stable reference point to anchor the light's position for the perceiver (Aronson, Wilson, & Akert, 2005). When participants were assessed individually, their estimates of how far the point of light moved varied greatly across participants. After this initial assessment, these participants were placed in a group with two other individuals (each having undergone the same prior experience individually) and were each asked to provide their estimate of how far the light had moved. Despite providing different initial estimates, the group would often generate a common estimate. To ensure that participants were not simply providing socially desirable estimates in front of the group (i.e., reaching consensus despite believing that their original estimate was correct), the participants were brought back on a different day and asked to make the same judgment without any other participant in the room. Again, participants were significantly more likely to provide the group's estimate over their own initial estimate. According to Sherif, the results indicated that the participants had been relying on each other as a source of information due to the ambiguity of the situation (referred to as *informational social influence*).

In another classic experiment, Asch (1951) investigated the power of conformity using a different perceptual judgment task. The purpose of Asch's study was to examine whether

conformity ceased to influence people's perceptual judgments when the situation was no longer ambiguous. In his experiment, Asch showed groups of nine two cards, one with a single reference line and the other with three comparison lines (labeled 1, 2, and 3). Students were asked to determine and announce out loud which of the three comparison lines on the second card most closely matched the length of the reference line on the first card. The lengths of the two incorrect comparison lines were generated in such a way to make the answer obvious, thereby making the situation unambiguous. Among the nine members in the group, eight were confederates of the experimenter. The seating arrangements of the students were set up in such a way to ensure that the actual subject in the experiment was called upon next-to-last in the group. The confederates were instructed beforehand to deliberately provide the same incorrect response on many of the trials. Despite the unambiguous nature of the situation, 76% of the participants conformed on at least one trial. Unlike the Sherif (1936) study, participants reported that they did not actually believe in their conforming answer but had simply conformed to avoid ridicule (referred to as *normative social influence*).

Studies on conformity have illustrated how social factors can affect perception. But what about internal states? Can internal factors, such as one's needs and desires, also influence perception? A paradigm shift in how perception was thought to be influenced gave rise to a new wave of research stemming from a particular theory in perception, known as the *New Look* approach.

New Look and its Empirical Support

The New Look approach to perception was first developed by Bruner and Goodman (1947), who posited that the perception of stimuli is not just an isolated process but rather is one that is also guided by internal events. More specifically, they suggested that perception is a constructive

process that is driven by top-down factors, such as the attitudes, needs, desires, and expectations of the individual. Bruner and Goodman further argued that the perceiver employs strategies for dealing with affective stimuli, which they termed the *perceptual defense and vigilance hypothesis*—the idea that the perception of stimuli may be enhanced (perceptual vigilance) or inhibited (perceptual defense) as function of the stimuli's affective quality. In their seminal study, Bruner and Goodman proposed that there existed three relevant principles in perception:

> "1. *The greater the social value of an object, the more will it be susceptible to organization by behavioral determinants*. It will be *selected* perceptually from among alternative perceptual objects, will become *fixated* as a perceptual response tendency, and will become perceptually *accentuated*.
> 2. *The greater the individual need for a socially valued object, the more marked will be the operation of behavioral determinants.*
> 3. *Perceptual equivocality will facilitate the operation of behavioral determinants only in so far as equivocality reduces the operation of autochthonous determinants without reducing the effectiveness of behavioral determinants*" (pp. 36-37).

Bruner and Goodman were particularly interested in examining what they termed, *accentuation*—the tendency for desirable objects to be seen with greater clarity. As a result, a series of experiments were performed investigating this issue. Thirty 10-year-old children of average intelligence were randomly assigned to one of three conditions: two experimental and one control. Participants were provided with an apparatus that had a knob on one end that could be turned to adjust the diameter of a circle of light that was projected onto a screen. Participants sat in a chair in front of the screen and were instructed to make the circle of light the same size as various objects. The task demands for the children in the two experimental groups were identical. Initially, each child was asked to estimate from memory the sizes of various coins, ranging from a penny to a half dollar, in both ascending and descending order. Participants were not given any corrective feedback after making their judgments. Then, they were asked to make the same judgments with the coins present. For each judgment, the corresponding coin was placed in the center of the participant's left palm for reference. Participants were granted unlimited time to

make their judgments. Children assigned to the control condition followed an identical procedure except for one major difference: instead of coins, identically-sized cardboard discs were used. Two main findings were found. First, size estimates for coins were significantly larger than were size estimates for cardboard discs. Second, the deviation between apparent size and actual size of the coins grew larger as the value of the coin increased. The results suggested that socially-valued objects are judged larger in size than objects without social value.

To assess the second proposed principle, a follow-up experiment was conducted (Bruner & Goodman, 1947). In Experiment 2, the experimental group was divided into two subgroups: a *poor* group and a *rich* group, with each comprising ten children; there was no control group. Children in the poor and rich groups were asked to estimate coin sizes both from memory and with the coins present, with the same value range and order of presentation as in Experiment 1. Consistent with their hypothesis, the authors found that children in the poor group significantly overestimated the coin sizes compared to children in the rich group, suggesting that poor children display a greater need for money (a socially valued object) than rich children. When the results for size estimations of coins were broken down by coin presence (coin present vs. coin absent) between poor and rich children, the following pattern emerged: the percent deviation between the apparent size and the actual size of the coins was greater among poor children when the coins were present compared to when they were absent, whereas the opposite was true among rich children.

In another study, a series of experiments were performed investigating the effects of need states (thirst and hunger) on matching the luminance of corresponding need-related objects, which were projected pictures of various food and liquid items (Gilchrist & Nesberg, 1952). For each experiment, participants were seated in a darkened room in front of a 12-foot projection

screen. They were provided with an apparatus with an attached knob for adjusting the luminance of the pictures. Once introduced to the apparatus, participants were told that they would be viewing a series of pictures, the order of which was randomized. Each picture was presented on the projection screen for 15 seconds before disappearing from view. After several intervening seconds, the picture reappeared but with a different level of luminance. Participants were instructed to adjust the luminance of the second picture to match that of the original by turning the knob. In Experiment 1, 26 participants were recruited from an introductory psychology course, all of whom were instructed beforehand to abstain from eating or drinking (except water) for a period of 20 hours prior to the onset of the experiment. Participants were randomly assigned to one of two groups—the *hungry* group or the *satiated* group—and were assessed for three sessions. Those assigned to the hungry group were provided a meal before their first session but were not given any food for the next two, resulting in the following abstinence periods (in hours) since their initial meal: 0, 6, and 20. Participants assigned to the satiated group underwent the same procedure except that they were provided meals before each of their three sessions. The results showed that hungry participants had a bias to overrate the luminance of the food pictures, whereas satiated participants did not; this effect became more pronounced as the abstinence period grew longer. Collectively, the results suggested that the motivational effects of need affected the perception of the need-related object.

In Experiment 2, the generalizability of the first experiment's results was assessed by applying the same procedure to thirst-induced participants judging the luminance of thirst-related objects. A total of 48 participants were recruited who all agreed to abstain from consuming food or liquids of any kind for at least 8 hours prior to the start of the experiment. Each participant underwent four experimental sessions, each separated by approximately 2.5 hours. Thus, each

participant was assessed at 0, 2.5, 5, and 7.5 hours after last consuming any food or liquid. Participants were randomly assigned to one of four groups. Those assigned to either Group I or II were permitted to eat and drink without restriction after beginning the first session. The only difference that existed between the two groups was that the same pitchers and glasses of water that appeared in the slides were also present on an adjacent table for participants in Group I but were absent for participants in Group II. The condition differences between Groups III and IV were the same as the condition differences between Groups I and II, respectively, except that participants in Groups III and IV were not permitted to eat or drink after beginning the first session. The aforementioned manipulations thus produced the following conditions: Group I, which was satiated with the need-related objects present; Group II, which was satiated with the need-related objects absent; Group III, which got increasingly thirstier with the need-related objects present; and Group IV, which got increasingly thirstier with the need-related objects absent. Preliminary analyses revealed that need-related object presence was neither significant as a main effect nor as an interaction with any other factor (i.e., satiation and session). As a result, need-related object presence was collapsed across subjects in the analysis for luminance matching accuracy. As in Experiment 1, increasing need (thirst) produced greater overestimates of the luminance of need-related objects (pitchers and glasses of liquids), supporting the generalizability of the results found in Experiment 1.

In Experiment 3, the authors sought to investigate whether any object, be it need-related or not, could produce the same effect. That is, does need bias luminance matching for any general object or for need-related objects only? To address this question, the effect of need deprivation on the luminance matching of need-related objects was compared with its effect on the luminance matching of homogenous color fields. The slides that were used in Experiment 3 were

the same as those used in Experiment 2 except for the addition of six slides. These additional slides consisted of the following color fields: red, green, blue, orange, blue-green, and yellow. A total of 48 participants were recruited who all agreed to abstain from consuming food or liquids of any kind for at least 8 hours prior to beginning the experiment. Each participant underwent four sessions, with the first three carried out 4 hours apart and the fourth following the third by 5 minutes. Participants were randomly assigned to one of four groups. Those assigned to Groups I and II were permitted to eat and drink without restriction during the course of the experiment. The difference between the two groups was that those in Group I were asked to match the luminance of the color slides, whereas those in Group II were asked to match the luminance of both the color slides and the need-related object slides. The treatment conditions of Groups III and IV were identical to Groups I and II, respectively, except that all participants were prohibited from eating or drinking during the time that spanned the first three sessions. The results showed that increasing need (thirst and hunger) produced greater overestimates of the luminance of need-related objects, whereas no such bias was present when matching the luminance of color slides. As in Experiment 2, the results of Experiment 3 further supported the study's initial findings.

The fourth and final experiment of Gilchrist and Nesberg's (1952) study assessed whether the difference in luminance matching between color and need-related slides was due to the differences in complexity of the slides themselves. As a result, Experiment 4 was performed with the following experimental parameters. A total of 12 participants were recruited who volunteered to abstain from consuming food or liquids of any kind for at least 8 hours prior to beginning the experiment. A within-subjects design was used such that every participant received the same treatment conditions, for which the experimental parameters were identical to what Group III of Experiment 3 received except that the "control" slides were colorful landscapes (i.e., a mountain

range, a grove of trees in autumn, and a park lawn and shrubs) instead of homogenous color fields. As expected, the bias to overestimate luminance was not present for the color landscapes. The results of the study suggest that rising need produces an increasing bias to overestimate the luminance of need-related objects, and that this bias is restricted to these objects.

In summary, the New Look approach to perception posits that visual perception is not just a function of optical variables, but is also a function of the organism's current internal states, such as its needs, desires, and expectancies (Bruner & Goodman, 1947; Witt, Proffitt, & Epstein, 2004). Accordingly, these influences on visual perception have been demonstrated empirically, as individuals have shown to perceive need-related objects as brighter and bigger compared to those unrelated to current need states (Bruner & Goodman, 1947; Gilchrist & Nesberg, 1952)

Criticisms of the New Look Approach

After the initial surge of studies in the literature supporting the New Look approach, a growing number of researchers began challenging its premise by highlighting specific methodological and conceptual problems, which caused the movement to be dormant in the literature for nearly a half century. One of the earliest critics of the New Look approach was Harold McCurdy (1956) who argued that schemas influence perception to a greater degree than do need and value. McCurdy conceded that values and needs may influence perception in "*some* way" (p. 167); however, memory schemas for valued objects likely play a more decisive role in how such objects are perceived. To illustrate his point, McCurdy offered a pointed critique of Burner and Goodman's (1947) coin study. According to Bruner and his colleagues (e.g., Bruner & Goodman, 1947; Bruner & Postman, 1949), the progressively increasing bias to overestimate the sizes of coins of increasing value demonstrates that the symbolic value of objects affects estimates of size. McCurdy, however, argued that this interpretation was critically flawed, as it

appeared to ignore the fact that smaller (in size, not value) coins may be underestimated. The size of a dime, for example, is not only underestimated but is done so to a greater degree than either a penny or a nickel, even though the value of a dime exceeds that of the others (Carter & Schooler, 1949). McCurdy hypothesized that the accuracy of size estimation for perceived objects is dependent upon the degree to which those objects belong to a *definite schema*. Contrary to intuition, he posited that size estimation accuracy would be lower for objects belonging to a definite schema relative to objects belonging to a less refined schema. McCurdy reasoned that schemas obviate the need to pay close attention to objects, thus leading to greater inaccuracy. Indeed, his hypothesis was supported by a contemporaneous study (Bruner & Rodrigues, 1953), which found that estimates of size for coins improved in accuracy when the coins were present compared to when they were absent. Furthermore, estimates of size for cardboard discs, which presumably have less refined schemas than do coins, were even more accurate.

Another major criticism of the perceptual defense and vigilance hypothesis has been referred to as the logical paradox. The paradox, which began to propagate in the literature in the early 1950s (e.g., Howie, 1952; Luchins, 1950), argued the following: if perceptual defense is truly perceptual in nature, then how is it that an individual can guard himself against an affectively negative stimulus without first perceiving it? Howie (1952) elaborated upon this criticism by elegantly arguing the following: "To speak of perceptual defense is to use a mode of discourse which must make any precise or even intelligible meaning of perceptual defense impossible, for it is to speak of perceptual process as somehow being both a process of knowing and a process of avoiding knowing" (p. 311). Erdelyi (1974) observantly pointed out that Howie made his argument by referring to "process" in singular form in relation to perception, thereby

implying that perception consists of a single process that is dichotomously expressed—that is to say that stimuli are either perceived or not perceived. Viewed in this light, perceptual defense (and vigilance) cannot exist as it was originally conceptualized. The paradox, however, ceases to maintain its credibility once perception is viewed within a multi-process framework (e.g., an information-processing model). For example, it may be the case that rudimentary characteristics of a given stimulus are briefly stored in a buffer and those that are likely to evoke negative emotional experiences are subsequently excluded from further processing and thus from conscious perceptual experience (Erdelyi, 1974).

Other critics of the New Look literature have argued that the apparent duality of the defense-vigilance effect cannot, by its very nature, be falsifiable. As noted earlier, perceptual defense refers to a relative increase in recognition threshold in response to emotional stimuli, whereas perceptual vigilance refers to a relative decrease in recognition threshold for such stimuli. Some researchers have found this duality unsettling given its post-hoc rationale for explaining threshold deviations—no matter which direction the deviation is observed to occur, a successful finding of a perceptual bias can be reported. The issue of duality, however, never rose to become a prominent concern in the literature, as the manner in which the effect is expressed has been successfully predicted in independent contexts (Carpenter, Wiener, & Carpenter, 1956; Chodorkoff, 1954; Eriksen, 1951, 1952, 1954; Hutt & Anderson, 1967; Lazarus, Eriksen, & Fonda, 1951; Matthews & Wertheimer, 1958; McGinnies & Adornetto, 1952; Moody, 1957; Singer, 1956; Spence, 1957; Stein, 1953). The basis of these studies stem from the idea that perceptual defense is associated with personality differences, and thus different modes of reacting to emotional stimuli (i.e., inhibition and vigilance). Others have gone so far as to propose a curvilinear relationship between sensitivity to affective stimuli and degree of

emotionality (e.g., Brown, 1961; Bruner & Postman, 1947). As a result, "perceptual defense" has been often used as a generic term to describe both sensitivity elevation and inhibition in response to affective stimuli.

A methodological issue in perceptual defense research that did gain early traction in the literature was the word-frequency problem (Howes, 1954; Howes & Solomon, 1950, 1951; Howie, 1952; Postman, 1953; Postman, Bronson, & Gropper, 1953; Solomon & Postman, 1952). Howes and Solomon (1950) were the first to bring this criticism to light, arguing that the perceptual defense effect was confounded by frequency of use differences between taboo and affectively neutral words. The basis of their argument (Howes & Solomon, 1950, 1951) stemmed from a series of scatterplots, graphing recognition thresholds against the logarithm of word frequencies, which yielded a correlation coefficient of -0.70. According to Howes and Solomon, this finding suggested that frequency differences could simulate perceptual defense effects due to the lower frequency of use of taboo words relative to affectively neutral words. However, the word frequency values that were used to base this evaluation on were taken from a teacher's reference aid on developmentally appropriate word span among schoolchildren, which may have represented an inadequate source since it may have greatly underestimated the frequency of taboo words used among a college population. As a result, Eriksen (1963) conducted a study to assess the adequacy of these word frequencies among college students by having participants define each of the words from the original list. Thus, adequacy of the original word frequency values was determined by the percentage of participants that could correctly define each word. For affectively neutral words, the correlation between word frequency and the number of correctly-given definitions was 0.57; for taboo words, the correlation was only 0.03, suggesting that the words chosen as "taboo" were indeed misleading and inadequate in describing their true

frequency of use. Compounding the problem even further, the word frequency values of the original word list went unchallenged by many, leading to the continued use of the flawed word list (Erdelyi, 1974).

Yet another problem existed with the word-frequency criticism. Although Howes and Solomon (1950, 1951) reported correlations that plotted recognition thresholds against the logarithm of word frequencies, their interpretation of the results failed to consider the logarithmic transformation itself. For instance, Howes and Solomon (1951) argued in their paper that "the probability of a word has an enormous effect on its visual duration threshold" (p. 401). This is simply not true, however, when the logarithmic transformation is taken into account. Not only was the effect small, but it was absent altogether throughout the majority of the frequency ranges that Howes and Solomon had examined. Upon closer examination of the original scatterplots, Erikson (1963) observed that practically no relationship existed between recognition threshold and word frequency within the range of 10-3,000 occurrences per million. Thus, the "enormous" effect that Howes and Solomon boasted about was only due to threshold differences between very frequent and very infrequent words. This observation was further supported by perceptual defense and vigilance outcomes that have been found in studies controlling for word-frequency effects (e.g., Chapman & Feather, 1972; Dulany, 1957; Levy, 1958; Pustell, 1957; Sales & Haber, 1968).

Another criticism of the perceptual defense literature was the expectancy-set argument (Freeman, 1954; Howie, 1952; Lacy, Lewinger, & Adamson, 1953; Luchins, 1950). Although not nearly as popular as the word-frequency criticism, the expectancy-set argument did generate some interest for a period of time (Cable, 1969; Forrest, Gordon, & Taylor, 1965). Those who championed the expectancy-set position argued that perceptual defense effects were largely the

product of participants' expectations of the affective quality of the stimuli. Luchins (1950) and others posited that perceptual defense outcomes could best be accounted for by expectancy-set based on two factors: (1) stimuli that are presented unexpectedly tend to have higher thresholds, and (2) subjects participating in a laboratory experiment do not generally expect affectively negative stimuli to be presented in an otherwise benign and safe environment. Interestingly, this point of view posed an internal conflict within the New Look faction, as advocates of one New Look theme (the effect that expectancies has on perception) were critical of another New Look theme (the effect that motives has on perception). The question has not been whether expectations have an effect on thresholds, as an abundant amount of evidence has shown that they indeed do have an effect (e.g., Cable, 1969; Forrest, Gordon, & Taylor, 1965; Lacy, Lewinger, & Adamson, 1953; Postman, Bronson, & Gropper, 1953); but rather, the more important question to ask is whether expectancy sets prohibit motivations (e.g., wishes and desires) from influencing perception as well. The need to address this core issue was obviated by what became the extensive documentation of perceptual vigilance outcomes (Bootzin & Stephens, 1967; Chapman & Feather, 1972; Dorfman, 1967; Dulany, 1957; Levy, 1958; Sales & Haber, 1968), which in and of itself belied the expectancy-set argument as a plausible, alternative account for explaining threshold changes to emotional stimuli. Furthermore, the expectancy-set hypothesis could not claim to be a more superior and parsimonious theoretical concept than perceptual defense. As Gibson (1941) noted in his review of set, the term has subsumed numerous concepts (e.g., mental set, preparatory set, goal set, motor set), thus representing "practically everything—and therefore nothing" (Erdelyi, 1974, p. 7). This issue persisted until the 1960s when the concept of set was positioned within the framework of perceptual selectivity, with processing strategies and encoding priorities playing critical roles for

the concept (e.g., Egeth, 1967; Haber, 1966). Viewed more broadly within the purview of perceptual selectivity, the concept of set becomes amenable to and compatible with perceptual defense, as it is merely another type of selectivity.

Perhaps the most significant criticism of the perceptual defense effect is the response bias position. The response bias criticism has taken the form of three different categories. The first to be reported in the literature is referred to as the *response suppression hypothesis*. Essentially, the hypothesis posits that participants recognize affectively neutral and taboo words with equal competence, but require longer exposure durations to report the taboo words because they may cause embarrassment. To investigate the validity of this argument, Nothman (1962) had participants report affectively neutral and taboo words orally and in written form (a mode of reporting that was intended to reduce embarrassment). Results showed that recognition thresholds were significantly lower when the response method was in written format compared to when it was oral, thus lending support to the response suppression hypothesis. However, numerous studies have produced results to the contrary (e.g., Ruiz & Krauss, 1968; Zigler & Yospe, 1960). Thought of another way, the response suppression hypothesis can be reformulated in terms of signal detection theory. Within this framework, the observer is equally sensitive to affectively neutral and taboo words, but assumes a more stringent decision criterion to report taboo words relative to affectively neutral words, resulting in a perceptual defense-like effect. Findings from the few studies that have used this signal detection approach appear to dispute the response suppression argument (e.g., Broadbent & Gregory, 1967; Chapman & Feather, 1972; Dorfman, 1967).

The second form of the response bias criticism is known as the *simple response bias*. Early proponents of the simple response bias (e.g., Goldiamond & Hawkins, 1958; Goldstein, 1962)

argued that observers produce biased responses based on a probabilistic hierarchy influenced by such things as past learning history and frequency factors. Consequently, correct recognition is thought to be biased toward high probability stimuli, independent of stimuli properties. Like previous criticisms of perceptual defense, this particular hypothesis of the response bias has come under a lot of scrutiny. Some have doubted, for example, that this type of bias can have a significant impact on recognition when considering how large the vocabulary system is in the English language (e.g., Kempler & Wiener, 1964; Wiener & Schiller, 1960). As Kempler and Wiener (1964) have noted, "why should *Ss* emit the particular word from several thousand likely words within the limits of the number of trials involved in a recognition task, if no cue is involved?" (p. 59). What's more, many others have made known their own personal criticisms of the simple response bias (e.g., Brown & Rubenstein, 1961; Zajonc & Nieuwenhuyse, 1964).

The third and final form of the response bias criticism has been termed the *part-cue response-characteristic* hypothesis. Advocates of the part-cue hypothesis speculate that some form of emotional input is initially registered, even under imperfect presentational conditions. They further argue that the perceptual defense effect is expressed by way of so-called response biases in the elaboration of such incomplete information. Some have argued, however, that the part-cue hypothesis is simply an explanation of perceptual defense rather than an absolute criticism of the effect (e.g., Erdelyi, 1974; Eriksen, 1963; Kempler & Wiener, 1963). Similarly, others have argued that the very idea that emotional input undergoes an elaboration process is certainly not an argument that is incompatible with the concept of perceptual defense (Gregory, 1966). Indeed, it is known that perceptual phenomena as a whole (e.g., depth perception, context and contrast effects) involve not just registration but elaborative and synthesizing processes as well (Anstis & Mather, 1985).

In summary, after initially enjoying widespread support in the literature, a number of ostensible methodological and conceptual problems levied against the New Look perspective were brought to light, leading to its temporary dormancy in the literature. Over time, however, it was found that the evidence used to support these criticisms were methodologically flawed in their own right, and thus were subsequently discredited. As a result, this provided an opportunity for the New Look perspective to regain its status in the literature.

Current Directions in the New Look Literature

As the different major criticisms of the New Look approach to perception became debunked over time, it gave rise to a second wave of New Look research that represented a significant extension of the existing literature. Researchers began acknowledging the utility of such research, exploring its premise through the prism of novel applications and contexts. Here, I review some of the representative literature of this second wave.

One study, for example, conducted three separate experiments demonstrating the degree to which effort plays a role in perceiving distance (Proffitt, Stefanucci, Banton, & Epstein, 2003). In the first experiment, participants were asked to make multiple distance judgments, in which one group was left unencumbered and the other was required to wear a heavy backpack while making these judgments. Distance judgments were made in a flat, university field; cones set up in a radial pattern around the participants were used to mark the predetermined distances that ranged from 1 to 7 m from the observer. The results indicated that those who were required to wear the backpack judged the distances to be significantly longer compared to those who were left unencumbered.

In the second experiment, anticipated walking effort was manipulated in a different fashion. Experiment 2 represented a systematic replication of an earlier study (Durgin et al., 2000), which

found that a visual-motor aftereffect could be produced from walking on a treadmill without optic flow. In the study performed by Durgin et al. (2000), optic flow was manipulated by having participants walk on a treadmill while wearing a head-mounted display, showing either a static or moving virtual environment. Once off the treadmill, participants were blindfolded and were instructed to walk in place until no other unattended motion was produced. Participants who did not experience optic flow were more likely to walk forward at a greater distance when attempting to remain in place than those who did experience optic flow. In this study, however, the actual speed that had been set on the treadmill was not commensurate with the rate of optic flow that was experienced form the virtual environment. As a result, Proffitt et al. (2003) performed a systematic replication by equating the rates of optic flow with that of actual walking speed. Despite this modification, the authors obtained a similar result, suggesting that participants' visual-motor system may have operated to anticipate a similar association between continued walking effort and zero optic flow. Proffitt et al. reasoned that this aftereffect "should also cause the system to anticipate an increase in the forward walking effort required to walk to a target" (p. 110). Thus, if anticipated walking effort does indeed affect distance judgments, then the visual-motor aftereffect should lead to higher estimates of perceived egocentric distance, which was the premise underlying Experiment 3.

In the third and final experiment of the Proffitt et al. (2003) study, participants made their distance judgments before and after treadmill adaptation. For pre-adaptation distance judgments, participants were asked to stand in a hallway and make three egocentric distance estimates in relation to a cone that was placed at 6, 8, and 10 m; a 1-ft ruler was used as a reference during these judgments. Participants were blindfolded while the distances of the cones were adjusted. During adaptation, participants wore a head-mounted display while walking on a treadmill for a

3-minute duration. At the conclusion of the adaptation period, participants were led off the treadmill and were blindfolded to replace the head-mounted display. For post-adaptation distance judgments, participants were asked to make a single egocentric distance estimate in relation to a cone that was placed 8 m from the observer. Consistent with their hypothesis, the authors found that participants provided greater distance estimates after having experienced no optic flow than when optic flow was present. Collectively, the results across the three experiments demonstrated that anticipated walking effort influences perceived egocentric distance, underscoring the functional qualities underlying perceptual experience.

A follow-up study was conducted by Witt, Proffitt, and Epstein (2004), which found that perceived distance is influenced by anticipated effort only when the effort is associated with an intended action that is relevant to the anticipated effort. Accordingly, the authors performed a series of experiments demonstrating this phenomenon. In Experiment 1, participants were placed in a flat, grassy field, standing in front of marked targets ranging in distance from 3 to 11 m from the observer. Half the participants were given a light ball and the other half was given a heavy ball. For each distance, participants were instructed to throw the ball as close as possible to the target three separate times. After completing the third throw, participants were asked to make an egocentric distance estimate to the target. Compared to those that threw the light ball, participants who threw the heavy ball provided significantly higher distance estimates for each target.

In Experiment 2, participants were presented with the same set of targets and asked to perform two actions for each target: (1) throw either a light or heavy ball to the target and (2) adjust the distance between two poles (perpendicular to the egocentric plane of the target) to

match the egocentric distance to the target. Those who threw the heavy ball adjusted the distance between the two poles to be at a greater distance compared to those who threw the light ball.

Similar to Experiment 2, participants in Experiment 3 were instructed to throw either a heavy or light ball up to three times for each target. After the last throw was made, participants were blindfolded, turned 180 degrees, and were asked to walk a distance that matched the egocentric distance to the original target. Although manipulating effort for throwing influenced distance judgments in the first two experiments, it was found not to influence walking blindfolded in the third experiment.

Witt et al. (2004) hypothesized that the intended action that participants anticipated to perform influenced whether perceived distance would be distorted. Accordingly, Experiment 4 assessed this hypothesis by introducing an intention manipulation, which the authors defined as "the action that the participants were anticipating performing immediately after making each distance judgment" (p. 584). Participants were randomly assigned to one of two groups. In each group, participants threw a heavy ball and made distance estimates for each target in a flat, grassy field. Participants assigned to one group were told beforehand that they would be given the same ball and asked to throw to each target with their eyes closed after making their original distance estimates, whereas those assigned to the other group were told beforehand that they would be blindfolded and asked to walk a distance that matched the egocentric distance to the target after making their original distance estimates. Although both groups underwent the same initial experience of throwing the heavy ball, only those that expected to blind-throw to the targets perceived them to be farther away than their actual distance compared to those that expected to blind-walk to the targets. Overall, the results of the study suggest that perception of egocentric distance is not just a function of the distance itself, but also is a function of the

intended action that is to be performed toward achieving the distal extent as well as the effort associated with it (Witt, Proffitt, & Epstein, 2004).

More recent studies of the second wave literature have re-visited the idea that motivational states can influence visual perception. Balcetis and Dunning (2006), for example, demonstrated that participants' interpretation of an ambiguous image is guided by their preferences. In the study's first experiment, participants were seated at a table and presented with two beverages: freshly squeezed orange juice (the desired beverage) and an odorous "veggie smoothie" (the undesired beverage). Participants were then told that a computer program would determine which of the two beverages they would be asked to drink. For half the participants, the number 13 (with the numbers spaced together to make it also look like the letter "B") would indicate that they had been assigned to drink the orange juice and the letter "B" would indicate that they had been assigned to drink the veggie smoothie. For the other half of participants, the opposite letter/number assignments were provided. The authors found that participants reported seeing the stimulus that would provide them with the more desired beverage. A systematic replication of the first experiment using a different ambiguous stimulus (an image that could be perceived as either a seal or horse) produced a similar result (Balcetis & Dunning, 2006, Experiment 2).

Balcetis and Dunning (2006), however, conceded that a competing explanation existed. That is, participants may have been aware of both interpretations at the time they viewed the stimulus and had simply reported seeing what they knew would result in receiving the more desirable beverage. As a result, the authors performed a third experiment to ensure that this was not indeed the case. To assess this competing explanation, participants' initial eye movements were recorded as a means of using an implicit measure given that they occur outside of conscious processing (Allopenna, Magnuson, & Tanenhaus, 1998; Richardson & Spivey, 2000). Similar to

Experiment 2, participants were asked to report whether they had seen a seal or horse after being told which would result in having to drink the orange juice and veggie smoothie. Next, they were shown two phrases on a computer screen—"farm animal" and "sea creature"—and examined which of the two received the participant's first saccade. Consistent with the authors' expectations, participants' first saccade tended to be directed toward the word stimulus that corresponded to their original self-report. This result was confirmed when a lexical decision task replaced the eye movement measure in a subsequent experiment (Balcetis & Dunning, 2006, Experiment 4). Taken together, the results provided converging evidence that perceiving ambiguous visual stimuli is influenced by people's motivational states.

Extending upon their 2006 study, Balcetis and Dunning (2010) investigated the influence of desirable objects on distance perception. In this study, the authors hypothesized that objects serving immediate goal-states would be seen as both more desirable and closer in proximity to the observer, reasoning that individuals perceive desirable objects in this manner because such a perceptual experience motivates approach behaviors that will aid in object attainment. Accordingly, a series of studies were performed confirming this hypothesis. In Study 1, participants were randomly assigned to one of two groups: a thirsty condition or a quenched condition. Those assigned to the thirsty condition consumed a single serving of pretzels (a high sodium food), whereas those assigned to the quenched condition were asked to consume as much water as they wanted from four 8-oz servings of water. All participants were then seated at a table with a water bottle placed on the far end, 36 in. away. On a form provided to them, participants recorded how long it had been since they last consumed a beverage. In addition, participants indicated on a 7-point Likert scale (1) how thirsty they were and (2) how appealing they found the water bottle to be. Participants were then given a 1-in. reference line and were

asked to make an egocentric distance estimate to the water bottle. The following results were found: (1) no significant difference was found between those in the thirsty and quenched conditions with respect to how long it had been since a beverage was last consumed; (2) those in the thirsty condition did indeed rate their level of thirst to be significantly higher than those in the quenched condition, thereby ensuring that the manipulation of inducing level of thirst produced its intended effect; (3) those in the thirsty condition rated the water bottle to be significantly more desirable than those in the quenched condition; and (4) participants in the thirsty condition perceived the water bottle to be significantly closer compared to participants in the quenched condition. In two subsequent studies, action responses involving other desirable objects were assessed (Study 3a and 3b). Participant action responses involved the manipulation of either an object (Study 3a) or the self (Study 3b) to attain a target distance. In each case, an action response was performed that was consistent with perceiving the desirable object as closer relative to a less desirable object.

Balcetis and Dunning (2010) demonstrated how desirability could influence the perceived distance of an object that has the capacity to satisfy an immediate physiological need. The authors argued that this perceptual bias serves to motivate the organism toward goal-directed action of acquiring the object. Conversely, undesirable objects that are non-threatening may be perceived as farther away than desirable objects as a way to produce the perception of a less unpleasant state. However, as Balcetis and Dunning noted, this may be situational. If an individual is confronted with an undesirable object that poses an actual, immediate threat (e.g., a poisonous snake nearby), then one may perceive the object to be closer than it's actual distance to encourage the organism to engage in escape behavior.

But what about undesirable objects that only pose a perceived (but not actual) threat? Phobic individuals tend to overestimate the threat value of phobia-related stimuli (Beck & Clark, 1997). Overestimating the likelihood and severity that a particular situation will be threatening often produces false catastrophic expectations of imminent danger, even in cases when the situation may be innocuous. With an increased sense of danger, anxious individuals may be more likely to perceive phobia-related stimuli as being closer than non-anxious individuals given that closer (threatening) objects, in general, are more likely to threaten the survival of an organism than are more distal objects.

To assess this hypothesis, Cole, Balcetis, and Dunning (2013) performed a study in which they brought participants into a room that had a semi-contained (using a tray) live tarantula on the table. Participants stood at a fixed distance from the tarantula and were asked to report on a Likert scale how threatened/frightened and disgusted they felt as well as to estimate their egocentric distance to the tarantula. Cole et al. found that participants saw the tarantula as physically closer with increasing levels of perceived threat; ratings of disgust, however, had no bearing on egocentric distance estimates.

Background on Specific Phobia

Specific phobia is characterized by an excessive and persistent fear of a particular object or situation that is disproportionate to the actual threat value of the situation. Fear associated with the phobia produces marked distress and/or functional impairment—academic, occupational, or social—resulting from the avoidance or anxious anticipation of encountering the phobic stimulus (American Psychiatric Association, 2000). Specific phobia is one of the most common disorders, with an estimated lifetime prevalence of 12% (Kessler, Berglund, Demler, Jin, & Walters, 2005);

75% of these individuals also experience at least one other phobia (Curtis, Magee, Eaton, Wittchen, & Kessler, 1998).

A number of approaches to studying specific phobia have taken hold in the literature, many of which have been guided by the cognitive model of anxiety. First developed by Beck, Emery, and Greenberg (1985), the cognitive model of anxiety is based on the notion that the misperception of innocuous stimuli as threatening or dangerous is a central feature of anxiety disorders. In addition to selectively processing information related to threat, anxious individuals also underrate their personal capacities to cope as well as the safety features present in their environment. Furthermore, the cognitive model posits that anxiety involves a complex interaction of physiological, behavioral, affective, and cognitive changes (Beck et al., 1985). At the physiological level, changes arise with increased sympathetic activation to prepare the organism for fight or flight. At the behavioral level, organisms: (a) take action by escaping or fighting, and (b) minimize risk-taking behavior to maximize safety. At the affective level, organisms experience feelings of fear and apprehension. Lastly, at the cognitive level, anxiety involves: (a) abstract symptoms such as cognitive distortions, recurring automatic thoughts, and fear-related beliefs; (b) sensory-perceptual symptoms such as hypervigilance; and (c) cognitive difficulties such as problems with concentration and reasoning. Various methods have been used to examine these changes, including those based on cognitive-experimental paradigms, neuroimaging techniques, self-report instruments, and psychophysiological measures.

Present Study

The studies performed by Balcetis and Dunning (2010) as well as Cole et al. (2013) illustrated nicely how approach and escape motivation, respectively, influence perception of egocentric distance to objects eliciting those motivations. However, these studies were not

without their own limitations. For instance, though Balcetis and Dunning (2010) observed participants performing an action response to a desirable object that was congruent with a motivation to approach the object, no association (i.e., correlation) was reported between degree of visual perceptual bias and extent of the action response. Perhaps no such association was found, in part, because the action response required of participants involved a specific goal (e.g., adjusting one's egocentric distance to an object until a specified distance was reached) rather than simply moving in relation to the object in isolation of any other concurrent goal. By removing extraneous goals from the action response, it may serve to better isolate a behavioral response that is more directly influenced by approach motivation, thus making it easier to find an expected relationship between degree of biased visual perception and extent of physical action. In the Cole et al. (2013) study, no action response was assessed for, thus precluding any examination of whether degree of biased visual perception for a threatening object bears a relationship to the magnitude of the associated action response.

The present study sought to discover an association between degree of biased visual perception and extent of a relevant action response by performing the following two experiments. In Experiment 1, relevant modifications to Study 1 of Balcetis and Dunning (2010) were made to examine the influence of approach motivation on visual perception, and whether these perceptions affect action responses in a direction congruent with this motivation, by comparing thirsty and quenched individuals. Increased desirability should not only lead thirsty individuals to perceive the water bottle to be closer in distance but to be larger in height (given that closer objects appear bigger in size than more distal objects) as well compared to quenched individuals; and that this perceptual bias should also influence the action response of thirsty individuals in a direction congruent with this increased desire to approach the water bottle. Here,

behavior influenced by approach motivation was assessed by comparing participants' step-back distance from the edge of the table before and after thirst (or thirst satiation) was induced while viewing the water bottle that was placed on the table. If biased visual perception influences physical action, then thirsty individuals should take a smaller step back from the edge of the table relative to their baseline distance than quenched individuals. Furthermore, the closer the water bottle is perceived—reflecting greater desirability—the shorter the distance that participants should step away from the water bottle.

In Experiment 2, the association between degree of biased visual perception and extent of a relevant action response was examined by comparing spider-tolerant and spider-fearful individuals within the context of both approach and escape motivation, with the latter receiving particular emphasis. For this experiment, participants were asked to make size (in length) and distance estimates to objects of varying levels of desirability to the observer. These objects included a $50 gift card, which participants were told beforehand that they would have a chance to win at the conclusion of the study (desirable condition); a business card (neutral condition); a contained tarantula (undesirable fear-relevant condition); and apparent feces (undesirable fear-irrelevant condition). In addition, the same step-back response measure from Experiment 1 was used for each object/condition to assess for action response magnitude. Afterwards, participants completed two spider-related questionnaires—the Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995) and the Spider Questionnaire (SPQ; Klorman, Weerts, Hastings, Melamed, & Lang, 1974); the FSQ was used to differentiate spider-fearful from spider-tolerant participants given its greater sensitivity in detecting differences between phobic and non-phobic samples than the SPQ. The purpose of administering the SPQ, on the other hand, was to examine which of the two questionnaires better correlates with perceptual judgment accuracy for

distance and size as well as with the step-back response, which has not been previously investigated in the literature. For Experiment 2, escape motivation should differentially influence spider-fearful and spider-tolerant individuals in relation to perceiving the distance and size of the contained tarantula, which in turn should differentially affect their respective action responses. Because spider-fearful individuals will be expected to perceive a greater level of threat toward the contained tarantula, they will also have a greater motivation to escape the situation compared to spider-tolerant individuals. Thus, spider-fearful individuals relative to spider-tolerant individuals should (1) perceive the contained tarantula as physically closer and bigger (i.e., longer); (2) take a bigger step away from the contained tarantula; and (3) take a bigger step away from the contained tarantula the closer, bigger, and more threatening it is perceived. In addition, if the FSQ is indeed better at discriminating between phobic and non-phobic samples, then participant scores on the FSQ should better correlate with perceptual judgment accuracy for distance and size than the SPQ. No group differences are expected for perceptual judgment accuracy and the step-back response involving the other three objects. Both spider-fearful and spider-tolerant individuals should perceive the gift card as closer in egocentric distance and bigger in size compared to the business card and apparent feces, given its expected value as a desirable object.

Overarching Purpose and Potential Implications

The overarching purpose of the present study is to examine how approach (and escape) motivation, and thus the adaptability of engaging in such behaviors, influences visual perceptual judgments and subsequent action responses within the context of spider phobia. By manipulating approach and escape motivation in this manner, we should see perceptual distortions that are commensurate with this degree of motivation. If there indeed is a relationship between degree of

spider-related fear and perceptual distortion, this may have clinical implications for how phobic individuals interpret (or rather, misinterpret) the threat value of phobia-related stimuli. That is, with greater perceptual distortions, the more likely it will be that phobic individuals will avoid such stimuli, thus further sustaining the maintenance of their anxiety. Furthermore, comparing how well the FSQ and SPQ predict the magnitude of these perceptual distortions and step-back responses can help to inform the relative clinical utility of each measure. If one measure is found to be a significantly better predictor over the other, the superior measure may serve to better assess treatment progress, as reductions in perceptual distortions and escape behavior should be associated with reductions in anxiety.

II. Experiment 1

Method

Participants

Ninety-four undergraduate students (M_{age} = 19.64 years, SD_{age} = 1.15 years; 77 female) seeking to earn extra credit for a psychology course were recruited, with 47 participants in each condition.

Materials

Each pretzel serving consisted of two 1.5-oz. packages of Snyder's of Hanover® Mini Pretzels, constituting a total of 30% of one's daily intake of sodium. All water bottles used in the experiment were 16.9-oz. bottles of Deer Park® water (height: 7.75 in.); labels for all water bottles were removed.

Design and Procedure

Participants stood at the edge of a table (that was marked by a tape placed on the floor) from a water bottle placed 36 in. away. Participants were instructed to stand on the tape such that the toe of their shoes was placed at the top edge of the tape. After taking this position, participants were told to take one step back while looking at the water bottle. The experimenter then measured (in inches) their stepping distance, from the toe of their shoe to the top edge of the tape. This measurement represented the baseline stepping distance for each participant.

Participants were then seated at the table. Those randomly assigned to the thirsty condition were told to consume two bags of pretzels, whereas those randomly assigned to the quenched

condition were told to consume as much water as they wanted from two bottles of water at room temperature. While consuming water or pretzels, participants were given a form and asked to record how many minutes it had been since they last ate and consumed a beverage. After consumption, participants used the back of the same form to indicate on separate 7-point Likert scales how thirsty they felt and how appealing they found the bottle of water placed in front of them. Participants were then given a 1-in. reference line and were asked to record their egocentric distance estimate to the water bottle as well as their estimate of its height, both given in inches. Next, participants were asked to stand on the tape and take one step back while looking at the water bottle. The measurement of their stepping distance was again taken. Afterwards, participants sat back at the table and were instructed to have the experimenter adjust the distance of the water bottle until they perceived an egocentric distance of 72 in (this task from this point forward will be referred to as "adjusted distance"). This was accomplished by the following: (1) the experimenter first asked each participant if the object should be moved toward or away from them; (2) while the object was in motion, they were instructed to tell the experimenter, "stop," once the object was perceived to be 72 in. away; (3) afterward, participants were asked if the distance of the object needed to be further adjusted; and (4) if so, steps 1-3 were repeated in sequence until participants reported that no further adjustments were needed. Participants were then debriefed and thanked for their time.

Results

Manipulation Checks

Separate independent-samples *t* tests confirmed that participants in the thirsty and quenched groups did not significantly differ in the amount of time since they last consumed a beverage ($M_{\text{Thirsty}} = 104.6$, $SD_{\text{Thirsty}} = 206.3$; $M_{\text{Quenched}} = 103.83$, $SD_{\text{Quenched}} = 194.16$), $t(92) = .02$, $p = .99$;

or food ($M_{Thirsty}$ = 168.17, $SD_{Thirsty}$ = 264.56; $M_{Quenched}$ = 167.06, $SD_{Quenched}$ = 210.94), $t(92) = .02$, $p = .98$. In addition, participants who consumed pretzels reported feeling more thirsty ($M = 5.66$, $SD = 1.15$) than those who consumed water ($M = 1.64$, $SD = 0.92$), $t(92) = 18.75$, $p < .001$, $d = 4.08$. As a result, participants in the thirsty condition perceived the water bottle to be more desirable ($M = 6.02$, $SD = 1.22$) than those in the quenched condition ($M = 2.62$, $SD = 1.29$), $t(92) = 13.1$, $p < .001$, $d = 2.71$.

Perceptual Judgment Accuracy

Estimates of egocentric distance, height, and adjusted distance involving the water bottle were converted to accuracy scores by subtracting the actual value of each from their respective perceived estimates, with negative scores indicating that the water bottle was perceived as closer or smaller than its actual value and positive scores indicating that the water bottle was perceived as farther or bigger than its actual value. Relative to participants in the quenched condition, those in the thirsty condition perceived the water bottle as closer in egocentric distance, replicating Balcetis and Dunning (2010). This result was confirmed by the following set of analyses.

A one-way multivariate analysis of variance (MANOVA) was performed to assess perceptual judgment accuracy for egocentric distance, water bottle height, and adjusted distance between thirsty and quenched individuals. The effect of group was significant, $F(3, 90) = 4.11$, $p < 0.01$. Subsequent tests of between-subjects effects revealed that this effect was driven by differences in egocentric distance estimates, $F(1, 92) = 6.31$, $p < 0.02$, $\eta_p^2 = 0.64$; rather than by differences in height estimates, $F(1, 92) = 1.63$, $p > 0.2$; and adjusted distance estimates, $F(1, 92) = 1.35$, $p > 0.2$. Figures 1, 2, and 3 illustrate perceptual judgment accuracy for egocentric distance, water bottle height, and adjusted distance, respectively.

Action Response

Because individual differences in height can affect a person's stepping distance, action responses of participants were converted to percentages by taking participants' step-back distance from the edge of the table after thirst (or thirst satiation) was induced and dividing it by their baseline distance, then multiplying this quantity by 100 (see Figure 4 for results). Thirsty individuals took a smaller step back from the water bottle relative to their baseline (M = 95.58, SD = 19.97) compared to quenched individuals (M = 106.95, SD = 20.92), as confirmed by a one-way ANOVA, $F(1, 92) = 7.23$, $p = 0.008$, $\eta_p^2 = .07$. Furthermore, the closer the water bottle was perceived, the shorter the distance that participants stepped away from the water bottle relative to their baseline distance, $r(94) = 0.37$, $p < .001$.

Discussion

Relative to participants in the quenched condition, those in the thirsty condition perceived the water bottle as closer in distance, replicating Balcetis and Dunning (2010). In turn, this perceptual bias affected participants' action responses in a direction congruent with their degree of approach motivation—individuals in the thirsty condition took a smaller step back from the water bottle relative to their baseline distance compared to individuals in the quenched condition. The closer the water bottle was perceived, the shorter the distance that participants stepped away from the water bottle relative to their baseline, suggestive of an increased desire to approach the water bottle. To our knowledge, the present study is the first to demonstrate a linear association between biased visual perception and behavior influenced by approach motivation.

Contrary to our hypothesis, however, participants in the thirsty condition did not perceive the water bottle as larger in height than those in the quenched condition. This null finding may be due to the following. The water bottles that participants in the quenched group drank from were

the same as those used for making perceptual judgments. Although the labels of all the water bottles were removed to reduce familiarity cues, the identical form factor of the water bottles may have been sufficient enough to give quenched individuals an advantage over thirsty individuals for judging the height of the water bottle. Should this hypothesis be reexamined, using a container of water that is unfamiliar to participants would better help determine whether the desirability of this object influences how big it is perceived.

Thirsty and quenched participants also did not differ in their perceptual judgment accuracy for adjusted distance. This null finding may have been found because the experimenter, rather than the participants themselves, adjusted the distance of the water bottle. In an ideal scenario, participants would have direct control over the movement of the water bottle; however, this was not possible because it would require participants to get up from their seated position to do so. To compensate for this limitation, the experimenter made every effort to move the water bottle at a steady and consistent rate across participants by fixating away from the participant and water bottle. Even with these precautions in place, it could not be ensured that the water bottle was moved at a uniform rate across participants.

Results of the present experiment support the notion that biases in visual perception for desirable objects exist to encourage the organism to engage in behaviors toward acquiring the object, as evidenced by participants taking a smaller step away from the water bottle the closer it was perceived. More importantly, these results demonstrate that the relationship between biased visual perception and behavior influenced by approach motivation exists along a continuum and thus can be explained in terms of magnitude, which would not be possible if the relationship were merely categorical. Accordingly, if the value of egocentric distance is known, one can use this information to help predict the extent of physical action that would be produced based on

this perceptual experience. The applicability of this predictive relationship should be explored in future studies. It is reasonable to think, for example, that this may offer clinicians an efficient method for generating a reinforcer preference list for child clients based on performing a series of simple perceptual judgment tasks. Other areas worth further exploration include the generalizability of the relationship between biased visual perception and behavior influenced by approach motivation (e.g., are greater biases in visual perception associated with how quickly action responses are performed?) and whether a similar relationship exists for objects that motivate escape behavior, the latter of which serving as an impetus for Experiment 2.

III. Experiment 2

Method

Participant Selection

Based on a power analysis, a total of 72 participants—36 in the spider-fearful group and 36 in the spider-tolerant group—were recruited in the final sample (M_{age} = 19.89 years, SD_{age} = 1.07 years; 60 female). Relevant parameters for this power analysis (e.g., expected heterogeneity, the correlation among the dependent measures) were determined by using pilot data as well as those borrowed from a related study (Cole, Balcetis, & Dunning, 2013). Participants whose scores were in the *top* 15 percent for the cohort on the FSQ were identified as spider-fearful, whereas participants whose scores were in the *bottom* 15 percent for the cohort on the FSQ were identified as spider-tolerant; this criterion has been used in previous studies to differentiate individuals with high and low spider-related fear (e.g., de Jong, Peters, & Vanderhallen, 2002; Gerdes, Pauli, & Alpers, 2009). Thus, a total of 240 participants were screened for the study.

Measures

The SPQ comprises 31 true-false items about fear of spiders. Estimates of internal consistency (Kuder-Richardson Formula 20) for the SPQ have been consistently high, ranging from 0.83 to 0.89 (Klorman et al., 1974). Appendix A shows the items listed on the SPQ.

The FSQ is an 18-item questionnaire, which asks the respondent to indicate on a 7-point Likert scale how strongly they agree with each spider-related scenario listed; scores can range from 18 to 126 (Szymanski & O'Donohue, 1995). The FSQ assesses current functioning by

explicitly using the word “now” for each scenario. The FSQ has shown excellent internal consistency (Cronbach’s alpha = 0.92) and reliability (split-half reliability coefficient = 0.89). Appendix B depicts the items listed on the FSQ.

Design

All participants underwent the same procedure. Perceptual judgments were made for four objects: a $50 gift card (desirable condition), a business card (neutral condition), a contained tarantula (undesirable fear-relevant condition), and a piece of apparent feces (undesirable fear-irrelevant condition). The order in which these objects were presented across participants was counterbalanced via Latin square. Each object was observed once and was placed on a table at one of the following distances from the observer: 36 in., 42 in., 48 in., or 54 in. These distances were determined through pilot testing with the following goal in mind: to create enough variability in the distances to minimize memorial anchoring of previous object placements while not varying them so significantly as to impair distance estimates for the more distal objects relative to the more proximal objects. The order of object distance was determined via a random number generator with replacement such that each distance position was occupied exactly once per participant. In addition, each object was oriented the same way across all participants.

The length of each object was defined to participants based on the following parameters. The length of the gift card and business card was defined as the distance from the left edge of the object to the right edge. Similarly, the length of the apparent feces was defined as the distance between the two lateral ends of the object. Lastly, the length of the contained tarantula was defined as the distance between the ends of its longest leg and that of the corresponding leg on the other side of its body.

After the baseline step-back response was measured as well as in between each object presentation, participants were escorted to an adjacent hallway outside the room and were asked to solve a set of Sudoku problems. The purpose of this distracter task was to remove any perceptual cues that the participant could have otherwise relied upon for determining the next object's distance relative to its predecessor.

Procedure

Participants first stood at the edge of a table that was marked by a tape placed on the floor. Participants were instructed to stand on the tape such that the toe of their shoes was placed at the top edge of the tape. After taking this position, participants were told to take one step back while looking straight ahead. The experimenter then measured (in inches) their stepping distance, from the toe of their shoe to the top edge of the tape. This measurement represented the baseline stepping distance for each participant.

For each condition, participants were seated at the table and were provided a form in which they were asked to indicate on separate 7-point Likert scales how desirable, threatening, and disgusting they found the object. Participants were then given a 1-in. reference line and were asked to record their egocentric distance estimate to the object as well as their estimate of its length, both given in inches. Next, participants were asked to stand on the tape and take one step back while looking at the object. The measurement of their stepping distance was again taken. Afterwards, participants sat back at the table and were instructed to have the experimenter adjust the distance of the object until they perceived an egocentric distance of 72 in. This was accomplished by the following: (1) the experimenter first asked each participant if the object should be moved toward or away from them; (2) while the object was in motion, they were instructed to tell the experimenter, "stop," once the object was perceived to be 72 in. away; (3)

afterward, participants were asked if the distance of the object needed to be further adjusted; and (4) if so, steps 1-3 were repeated in sequence until participants reported that no further adjustments were needed. At the conclusion of the experiment, participants were administered the SPQ and FSQ in a separate room. Participants were then debriefed and thanked for their time.

Results

Sample Characteristics

Spider-fearful and spider-tolerant individuals did not significantly differ in age, as confirmed by an independent-samples *t* test, $t(70) = 0.44$, $p = 0.66$. Mean age was 19.94 (SD = 1.07) for spider-fearful individuals and 19.83 (SD = 1.08) for spider-tolerant individuals. The proportion of females was higher among spider-fearful individuals (86%) than among spider-tolerant individuals (81%); however, this difference was not statistically significant, as confirmed by an independent-samples *t* test, $t(70) = 0.63$, $p = 0.53$. Additionally, spider-fearful individuals endorsed more spider fear-relevant symptoms on the FSQ than spider-tolerant individuals, as confirmed by an independent-samples *t* test, $t(44) = 43.23$, $p < 0.001$, $d = 10.19$. Mean FSQ score was 92.33 (SD = 9.16) for spider-fearful individuals and 22.03 (SD = 3.36) for spider-tolerant individuals. Similarly, spider-fearful individuals endorsed more spider fear-relevant symptoms on the SPQ than spider-tolerant individuals, as confirmed by an independent-samples *t* test, $t(54) = 17.64$, $p < 0.001$, $d = 4.16$. Mean SPQ score was 18.83 (SD = 4.68) for spider-fearful individuals and 3.19 (SD = 2.53) for spider-tolerant individuals. FSQ scores bore a strong relationship to SPQ scores among spider-fearful and spider-tolerant participants, $r(72) = 0.93$, $p < 0.001$.

Manipulation Checks

Figures 5-7 illustrate desirability, threat, and disgust ratings, respectively, as a function of group and object. As expected, spider-fearful individuals found the contained tarantula significantly less desirable than spider-tolerant individuals ($M_{Fearful}$ = 1.31, $SD_{Fearful}$ = 0.67; $M_{Tolerant}$ = 2.50, $SD_{Tolerant}$ = 1.54). As a result, spider-fearful individuals found the contained tarantula significantly more threatening than spider-tolerant individuals ($M_{Fearful}$ = 6.17, $SD_{Fearful}$ = 1.00; $M_{Tolerant}$ = 1.83, $SD_{Tolerant}$ = 0.85). As expected, no group differences were found for ratings of disgust; rather, the objects themselves did differ in the level of disgust that was elicited. Specifically, both the apparent feces (M = 5.69, SD = 1.27) and contained tarantula (M = 4.26, SD = 1.78) were rated significantly more disgusting than the gift card (M = 1.07, SD = 0.48) and business card (M = 1.01, SD = 0.12); and the apparent feces was rated significantly more disgusting than the contained tarantula. Results for assessing differences between spider-fearful and spider-tolerant individuals for ratings of desirability, threat, and disgust were confirmed by the following set of analyses.

A 2 (Group: spider-tolerant, spider-fearful) x 4 (Object: gift card, business card, apparent feces, contained tarantula) mixed design ANOVA was performed to assess ratings of desirability between spider-tolerant and spider-fearful participants. The effect of group was significant, $F(1, 70) = 9.15$, $p = 0.003$, $\eta_p^2 = 0.12$. Tests of within-subjects effects revealed that the factor of object was significant, $F(3, 210) = 285.35$, $p < 0.001$, $\eta_p^2 = 0.80$; as was the interaction between group and object, $F(3, 210) = 4.20$, $p = 0.006$, $\eta_p^2 = 0.06$. A subsequent simple-effects analysis revealed that this interaction was driven by differences between the two groups in the desirability ratings of the contained tarantula, $F(1, 210) = 22.56$, $p < 0.001$, $\eta_p^2 = 0.10$; rather than by

differences in the desirability ratings of the gift card, $F(1, 210) = 1.25$, $p = 0.26$; business card, $F(1, 210) = 0.77$, $p = 0.38$; and apparent feces, $F(1, 210) = 0.05$, $p = 0.82$.

A second 2 (Group: spider-tolerant, spider-fearful) x 4 (Object: gift card, business card, apparent feces, contained tarantula) mixed design ANOVA was performed to assess ratings of threat between spider-tolerant and spider-fearful participants. The effect of group was significant, $F(1, 70) = 127.82$, $p < 0.001$, $\eta_p^2 = 0.65$. Tests of within-subjects effects revealed that the factor of object was significant, $F(3, 210) = 322.35$, $p < 0.001$, $\eta_p^2 = 0.82$; as was the interaction between group and object, $F(3, 210) = 187.49$, $p < 0.001$, $\eta_p^2 = 0.73$. A subsequent simple-effects analysis revealed that this interaction was driven by differences between the two groups in the threat ratings of the contained tarantula, $F(1, 210) = 753.42$, $p < 0.001$, $\eta_p^2 = 0.78$; rather than by differences in the threat ratings of the gift card, $F(1, 210) = 0.001$, $p = 0.97$; business card, $F(1, 210) = 0.0004$, $p = 0.98$; and apparent feces, $F(1, 210) = 0.003$, $p = 0.96$.

A third 2 (Group: spider-tolerant, spider-fearful) x 4 (Object: gift card, business card, apparent feces, contained tarantula) mixed design ANOVA was performed to assess ratings of disgust between spider-tolerant and spider-fearful participants. The effect of group was not significant, $F(1, 70) = 0.91$, $p = 0.34$; as was the interaction between group and object, $F(3, 210) = 0.17$, $p = 0.92$. However, the main effect of object was significant, $F(3, 210) = 322.18$, $p < 0.001$, $\eta_p^2 = 0.82$. Tukey's HSD post-hoc test revealed that both the apparent feces and contained tarantula were rated significantly more disgusting than the gift card and business card (p's < 0.001); and the apparent feces was rated significantly more disgusting than the contained tarantula ($p < 0.001$). All other comparisons were not statistically significant (p's > 0.9).

Of important note, the perceived intensity of the affective quality of the undesirable threat-relevant (contained tarantula) and undesirable threat-irrelevant objects (apparent feces) was

equivalent. Ratings of threat for the contained tarantula did not differ from ratings of disgust for the apparent feces among spider-fearful participants, as confirmed by a paired-samples t-test, $t(35) = 1.31$, $p = 0.20$.

Perceptual Judgment Accuracy

Similar to Experiment 1, estimates of egocentric distance, length, and adjusted distance involving each object were converted to accuracy scores by subtracting the actual value of each from their respective perceived estimates, with negative scores indicating that the object was perceived as closer or smaller than its actual value and positive scores indicating that the object was perceived as farther or bigger than its actual value. Preliminary analyses revealed that both object order and object position were neither significant as a main effect nor as an interaction with any other set of factors (p's > 0.4). As a result, object order and object position were collapsed across participants in the analyses for perceptual judgment accuracy. Figures 8, 9, and 10 illustrate perceptual judgment accuracy for egocentric distance, object length, and adjusted distance, respectively. Spider-fearful participants perceived the contained tarantula as closer in distance and longer in size than spider-tolerant individuals, as confirmed by the following set of analyses.

A doubly MANOVA was performed to assess perceptual judgment accuracy for egocentric distance, object length, and adjusted distance as a function of object (i.e., gift card, business card, apparent feces, contained tarantula) and group (i.e., spider-tolerant and spider-fearful individuals). The effect of group was significant, $F(3, 68) = 4.76$, $p = 0.005$, $\eta_p^2 = 0.17$; as was the effect of object, $F(9, 62) = 8.28$, $p < 0.001$, $\eta_p^2 = 0.55$; and the interaction between group and object, $F(9, 62) = 4.40$, $p < 0.001$, $\eta_p^2 = 0.39$.

To interpret this interaction, four separate one-way MANOVAs were performed to assess perceptual judgment accuracy for egocentric distance, object length, and adjusted distance between spider-tolerant and spider-fearful individuals for each object. For the contained tarantula, the effect of group was significant, $F(3, 68) = 15.85$, $p < 0.001$, $\eta_p^2 = 0.41$. Subsequent tests of between-subjects effects revealed that this effect was driven by differences in egocentric distance estimates, $F(1, 70) = 17.49$, $p < 0.001$, $\eta_p^2 = 0.20$; and object length estimates, $F(1, 70) = 37.49$, $p < 0.001$, $\eta_p^2 = 0.35$; rather than by differences in adjusted distance estimates, $F(1, 70) = 0.05$, $p = 0.82$.

No group differences were found from the three other one-way MANOVAs, as the effect of group was not significant for the gift card, $F(3, 68) = 0.12$, $p = 0.95$; business card, $F(3, 68) = 1.49$, $p = 0.23$; and apparent feces, $F(3, 68) = 0.22$, $p = 0.88$.

As participants endorsed higher degrees of spider-related fear and perceived greater levels of threat, they perceived the contained tarantula as closer in egocentric distance and bigger (i.e., longer) in size (see Figures 11-16). Greater levels of perceived disgust, however, was not associated with egocentric distance (see Figure 17) and length estimates (see Figure 18) for the contained tarantula. These results suggest that perceived threat rather than disgust biased visual perception for the contained tarantula, which was confirmed by the following analyses. As participants endorsed higher degrees of spider-related fear on the FSQ, they perceived the contained tarantula as closer in distance, $r(240) = -0.25$, $p < 0.001$; and longer in size, $r(240) = 0.28$, $p < 0.001$. A similar relationship was found between SPQ scores and egocentric distance estimates, $r(240) = -0.22$, $p < 0.001$; and between SPQ scores and length estimates, $r(240) = 0.25$, $p < 0.001$. The directionality of this relationship was also maintained with ratings of threat, as higher threat ratings for the contained tarantula were associated with closer egocentric

distance estimates, $r(240) = -0.18$, $p = 0.006$; and bigger length estimates for the tarantula, $r(240) = 0.30$, $p < 0.001$. Ratings of disgust for the contained tarantula bore neither a relationship to egocentric distance estimates, $r(240) = -0.06$, $p = 0.34$; nor to length estimates for the tarantula, $r(240) = 0.04$, $p = 0.51$.

The FSQ was not significantly better at predicting egocentric distance estimates to the contained tarantula compared to the SPQ, which was confirmed by testing differences between two dependent correlation coefficients, $t(237) = 0.65$, $p = 0.52$. Similarly, the FSQ was not significantly better at predicting length estimates of the contained tarantula compared to the SPQ, $t(237) = 0.91$, $p = 0.36$.

Action Response

Similar to Experiment 1, action responses of participants were converted to percentages by taking participants' step-back distance from the edge of the table while viewing the object and dividing it by their baseline distance, then multiplying this quantity by 100. Compared to spider-tolerant participants, spider-fearful participants took a bigger step back from the contained tarantula relative to their baseline (see Figure 19). This result was confirmed by the following set of analyses.

A 2 (Group: spider-tolerant, spider-fearful) x 4 (Object: gift card, business card, apparent feces, contained tarantula) mixed design ANOVA was performed to assess the step-back response between spider-tolerant and spider-fearful participants. The effect of group was significant, $F(1, 70) = 4.22$, $p = 0.04$, $\eta_p^2 = 0.06$. Tests of within-subjects effects revealed that the factor of object was significant, $F(3, 210) = 11.41$, $p < 0.001$, $\eta_p^2 = 0.14$; as was the interaction between group and object, $F(3, 210) = 7.37$, $p < 0.001$, $\eta_p^2 = 0.10$. A subsequent simple-effects analysis revealed that this interaction was driven by differences between the two groups in the

step-back response to the contained tarantula, $F(1, 210) = 28.00$, $p < 0.001$, $\eta_p^2 = 0.12$; rather than by differences in the step-back response to the gift card, $F(1, 210) = 0.19$, $p = 0.66$; business card, $F(1, 210) = 0.17$, $p = 0.68$; and apparent feces, $F(1, 210) = 0.67$, $p = 0.41$.

The closer the contained tarantula was perceived by participants, the longer the distance that participants stepped away from the contained tarantula relative to their baseline distance (see Figure 20), $r(240) = -0.20$, $p = 0.002$. Step-back responses were related to degree of spider-related fear on the FSQ, $r(240) = 0.37$, $p < 0.001$; and SPQ, $r(240) = 0.35$, $p < 0.001$; as well as ratings of threat, $r(240) = 0.43$, $p < 0.001$ (see Figures 21-23, respectively). These results suggest that greater levels of perceived threat were associated with participants' taking a bigger step away from the contained tarantula. Greater levels of perceived disgust were associated with step-back responses in a similar manner, albeit to a lesser degree (see Figure 24), $r(240) = 0.19$, $p = 0.003$. The FSQ was not significantly better at predicting the step-back response of participants to the contained tarantula compared to the SPQ, which was confirmed by testing differences between two dependent correlation coefficients, $t(237) = 0.63$, $p = 0.53$.

In addition, the closer the business card was perceived by participants, the longer the distance that participants stepped away from the object relative to their baseline distance (see Figure 25), $r(240) = -0.20$, $p = 0.002$. Because spider-tolerant and spider-fearful participants did not differ in their egocentric distance estimates and step-back responses to the business card, this suggests that this relationship resulted from the responses of participants who did not meet criterion for either group. No significant associations were found between egocentric distance estimates and step-back responses for the gift card, $r(240) = -0.07$, $p = 0.31$; and apparent feces, $r(240) = 0.01$, $p = 0.93$ (see Figures 26 and 27, respectively).

The bigger (i.e., longer) the contained tarantula was perceived by participants, the longer the distance that participants stepped away from the object relative to their baseline distance (see Figure 28), $r(240) = 0.14$, $p = 0.03$. However, no significant associations were found between length estimates and step-back responses for the gift card, $r(240) = -0.04$, $p = 0.54$; business card, $r(240) = 0.03$, $p = 0.60$; and apparent feces, $r(240) = 0.10$, $p = 0.13$ (see Figures 29-31, respectively).

Discussion

Compared to spider-tolerant individuals, spider-fearful individuals perceived the contained tarantula as closer in distance and longer in size. As participants endorsed higher degrees of spider-related fear (on the FSQ and SPQ) and perceived greater levels of threat, they perceived the contained tarantula as closer in egocentric distance and longer in size. Greater levels of perceived disgust, however, was not associated with egocentric distance and length estimates for the contained tarantula. These results suggest that perceived threat rather than disgust biased visual perception for the contained tarantula. Furthermore, the FSQ was not significantly better at predicting egocentric distance and length estimates to the contained tarantula compared to the SPQ, which suggests that neither instrument offered an advantage in predicting the magnitude of these given perceptual biases.

The results further indicated that the observed biases in visual perception among spider-fearful individuals affected their action responses in a direction congruent with a motivation to escape. Compared to spider-tolerant participants, spider-fearful individuals took a bigger step back from the contained tarantula relative to their baseline. The closer and bigger the contained tarantula appeared to participants, the longer the distance that participants stepped away from the object relative to their baseline distance. Step-back responses were also associated with degree of

spider-related fear on the FSQ, SPQ, as well as ratings of threat and disgust. These results demonstrated that not only does a linear relationship exist between biased visual perception and behavior influenced by *approach* motivation (see Experiment 1) but that this relationship also exists between biased visual perception and behavior influenced by *escape* motivation. Just as with egocentric distance and length estimates, the FSQ provided no significant advantage at predicting the step-back response of participants to the contained tarantula compared to the SPQ. As expected, no group differences were found for egocentric distance and length estimates for the gift card, business card, and apparent feces.

Surprisingly, however, the step-back responses of participants bore no relationship to their respective egocentric distance estimates to both the gift card and apparent feces. That is, as participants perceived the gift card as closer in distance, they did not take a smaller step away from it, which would be an expected action response to a desirable object. Though both spider-fearful and spider-tolerant individuals perceived the gift card as closer in egocentric distance and took a smaller step away from it (relative to their baseline) compared to the other three objects, the degree of biased perception for egocentric distance was not associated with the extent of the physical action. A closer examination of the data suggests that no such association was likely found because the majority of the data points clustered together within a limited range, as shown in Figure 23. A similar observation was found for the apparent feces when examining the relationship between degree of biased perception for egocentric distance to the object and the extent of the respective step-back response, as shown in Figure 24.

Similar to Experiment 1, the measure of adjusted distance did not produce any group differences across the four objects. Furthermore, perceptual judgment accuracy for adjusted distance was nearly identical across the four objects, irrespective of group. Because the same

methodology was used from Experiment 1 for the adjusted distance task (i.e., the experimenter having direct control over the movement of the object), the question still remains as to whether an effect would have been observed had there been a way for participants to directly control the movement of the objects while remaining in their seated position. Again, the experimenter made a concerted effort to move each object at a steady and identical rate across participants by fixating away from the participant and the given object. Nonetheless, these precautions could not produce the necessary amount of precision needed to significantly mitigate the limitations of this methodology. Should a similar measure of adjusted distance be implemented in future studies, using a virtual reality environment in which participants can manipulate the depth of an object using a button box may be worth exploring. If created realistically enough, one could also have participants perform other perceptual judgment tasks using the same virtual reality structure, such as those performed in this study.

Results of the present experiment support the notion that biases in visual perception for objects eliciting perceived threat exist to encourage the organism to engage in escape-like behaviors, as evidenced by participants taking a bigger step away from the contained tarantula the closer and bigger it was perceived. Such a behavioral response mimics a typical flight reaction toward perceived danger. If running away is not a viable option, the next logical choice is to back up in order to increase one's distance to the threatening object. This type of flight response is adaptive, as it provides the organism more time to react in the face of danger as well as to look for alternative, unexplored ways to escape the situation, should they be available. In this way, having participants take a step back from the contained tarantula maps on well to natural human behavior when confronted with perceived or actual threat.

IV. General Discussion

The present study performed two experiments examining the influence of approach and escape motivation on visual perception, and whether these perceptions affect action responses in a direction congruent with these respective motivations, by comparing thirsty and quenched individuals (Experiment 1) as well as spider-fearful and spider-tolerant individuals (Experiment 2). In each experiment, a linear relationship was found between the degree of biased visual perception and the extent of subsequent action responses. In Experiment 1, thirsty individuals took a smaller step away from the water bottle the closer it was perceived compared to quenched individuals. In Experiment 2, participants took a bigger step away from the contained tarantula (1) the closer it was perceived, (2) the bigger it was perceived, (3) the greater their endorsement of spider-related fear, and (4) the greater their level of perceived threat to the contained tarantula.

From an evolutionary perspective, perceived proximity encourages action—approach in the case of desirable objects (e.g., gift card, water bottle for thirsty individuals) and escape in the case of threatening objects (e.g., contained tarantula among spider-fearful individuals). Indeed, this bias in visual perception is adaptive, as it motivates the organism toward goal-directed action that maximizes its chances of survival. For instance, if a primary reinforcer such as food is perceived, then the likelihood of its attainment will be higher if the organism anticipates that it would require minimal physical effort, as would be the case if the source of food appeared closer than its actual distance. Likewise, if a threatening object such as a poisonous snake is perceived, then the likelihood of prompt action to escape (to ensure the survival of the organism) will be

higher if the organism perceives greater imminent danger, as would be the case if the poisonous snake appeared closer than its actual distance from the observer. Of course, encountering a poisoning snake would produce such perceptual distortions in any typical population, as it represents an *actual* form of threat. What Experiment 2 asked was whether such perceptual distortions would still be observed when the form of threat was *perceived* but not actual; and if so, how this would impact a subsequent action response relationally. This study demonstrated that perceived threat was more than sufficient enough to produce these perceptual distortions, which impacted action responses in a linear fashion.

From a broader perspective, this study revealed that visual perception and action responses are not mutually exclusive processes but rather are interconnected psychological events, which can be partially predicted relationally. Egocentric distance and size of an object may represent only two properties of many that could exist to explain this linear relationship between visual perception and physical action. If more environmental properties can be identified to produce greater predictive power of this relationship, then it may lend support to the notion that the perception-action link is actually a shared dimension of the overall human experience—just as the theory of relativity posits with the space-time continuum.

Although the present findings support a functional explanation, valid alternative explanations must be considered as well. Previous research, for example, has found that one's current affective state can influence how an object, unassociated with that affective state, is visually perceived. One study found that participants who recalled a sad story prior to standing next to a hill perceived it to be steeper than participants who did not have to recall a sad story (Riener, Stefanucci, Proffitt, & Clore, 2011). Even though the hill itself was not responsible for producing a sad emotional state, the perception of it was nonetheless biased because of a

contiguous affective state that carried over to a different context. Thus, biased visual perception for an object can be observed independent of its functional value to the observer. The present study did not assess for participant mood prior to making their perceptual judgments and action responses. As a result, it cannot be determined whether affective states unrelated to the objects used in this study influenced any of the dependent measures that were examined.

The narrowing of attention resulting from perceived threat may also influence perception for egocentric distance. Chajut and Algom (2003) found that the range of visual attention is disproportionately narrowed when threatening objects are perceived in the environment. This narrowing of attention, in turn, may lead individuals to perceive objects to be closer than their actual distance. A study that supported this notion found that hungry individuals who concentrated their focus to cookies perceived the food item to be 15% closer compared to individuals who had a wider range of focus (Balcetis, 2006). Thus, it stands to reason that spider-fearful individuals may have perceived the contained tarantula to be closer because their range of visual attention was narrowed relative to the apparent feces and business card. Though one could view the narrowing of attention as an alternative explanation to the functional perspective of the New Look literature, this could also simply represent the physiological mechanism by which the functional response is expressed.

From a global perspective, the present findings potentially provide some practical applications in the clinical sphere. As stated previously, a linear relationship was found between degree of spider-related fear (as well as degree of biased visual perception of the contained tarantula) and the step-back response to the contained tarantula. That is, the greater the endorsement of fear was to spiders, the more exaggerated participants' escape-like response (i.e., step-back response) was to the contained tarantula. Because greater tendencies to avoid/escape a

feared stimulus is associated with long-term maintenance of the phobia, it stands to reason that such behavior can be a good indicator for which individuals may be at greater risk for noncompliance and/or attrition in exposure therapy. The maintenance of many anxiety disorders is quite robust, thus making attrition in exposure therapy always a possible concern. Treatment for Posttraumatic Stress Disorder that includes both psychotherapy and pharmacotherapy, for example, has often been associated with high attrition rates, ranging from 20 to 38% (Rauch, Eftekhari, & Ruzek, 2012). Given this clinical reality, it is imperative that clinicians better identify through early detection those clients who are at greatest risk for treatment dropout. Toward this end, future research should examine whether the perception-action link associated with escape motivation bears a relationship to attrition rates in psychotherapy for the treatment of specific phobia. If greater degrees of step-back responses to distorted visual perceptions of phobic stimuli are associated with higher attrition rates, then one could potentially use this data to help identify those clients who are especially vulnerable to dropout from therapy. If these patients can be identified early on in therapy using such behavioral tasks used here, then it can provide the clinician with an opportunity to intervene a priori rather than be reactive post-hoc to treatment resistance/noncompliance. For example, this information could inform the clinician to spend more time using a motivational interviewing framework to help transition the client to the preparation stage of change in anticipation of client resistance. Such data may serve to help reduce attrition rates in exposure therapy contexts.

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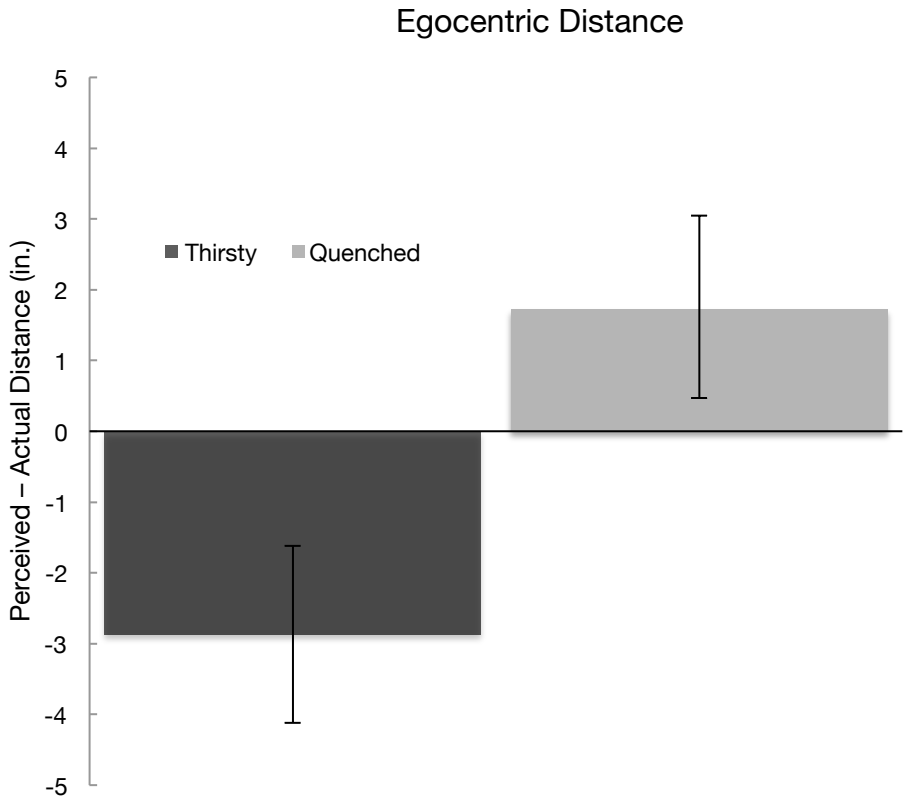

Figure 1. Mean perceptual judgment accuracy (+/- 1 SEM) for egocentric distance to the water bottle as a function of condition.

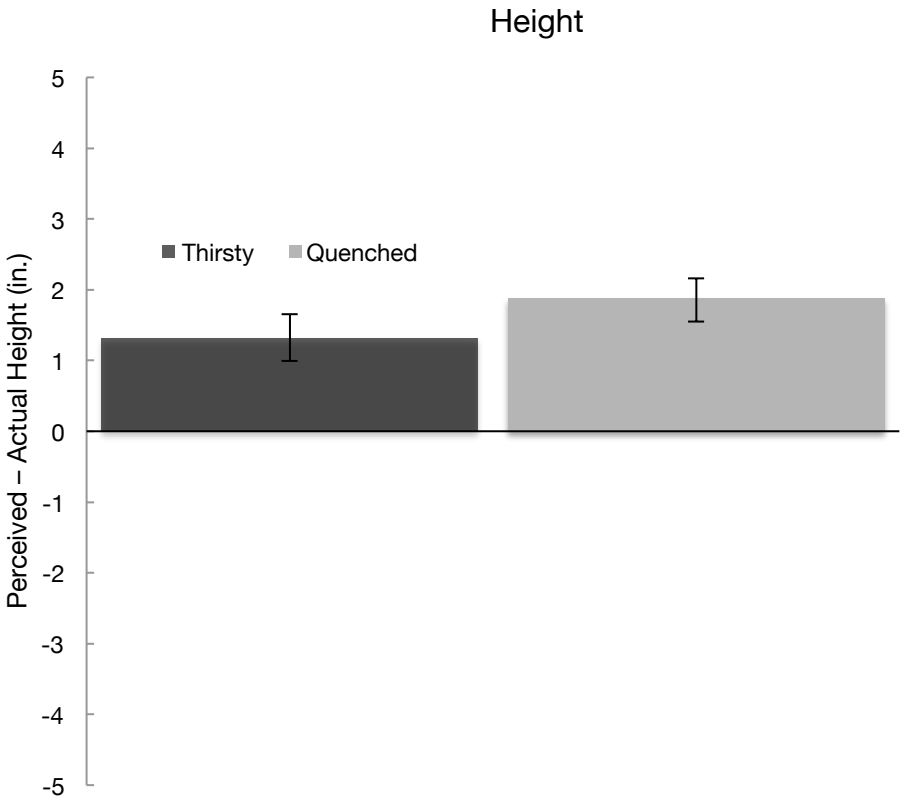

Figure 2. Mean perceptual judgment accuracy (+/- 1 SEM) for water bottle height as a function of condition.

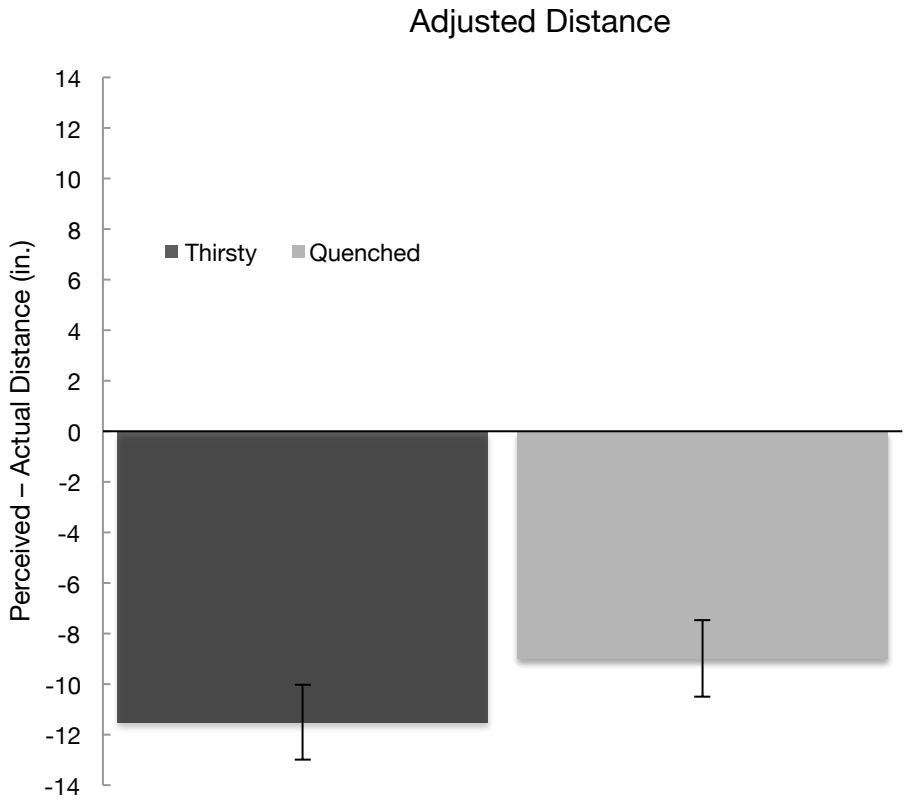

Figure 3. Mean perceptual judgment accuracy (+/- 1 SEM) for adjusted distance to the water bottle as a function of condition.

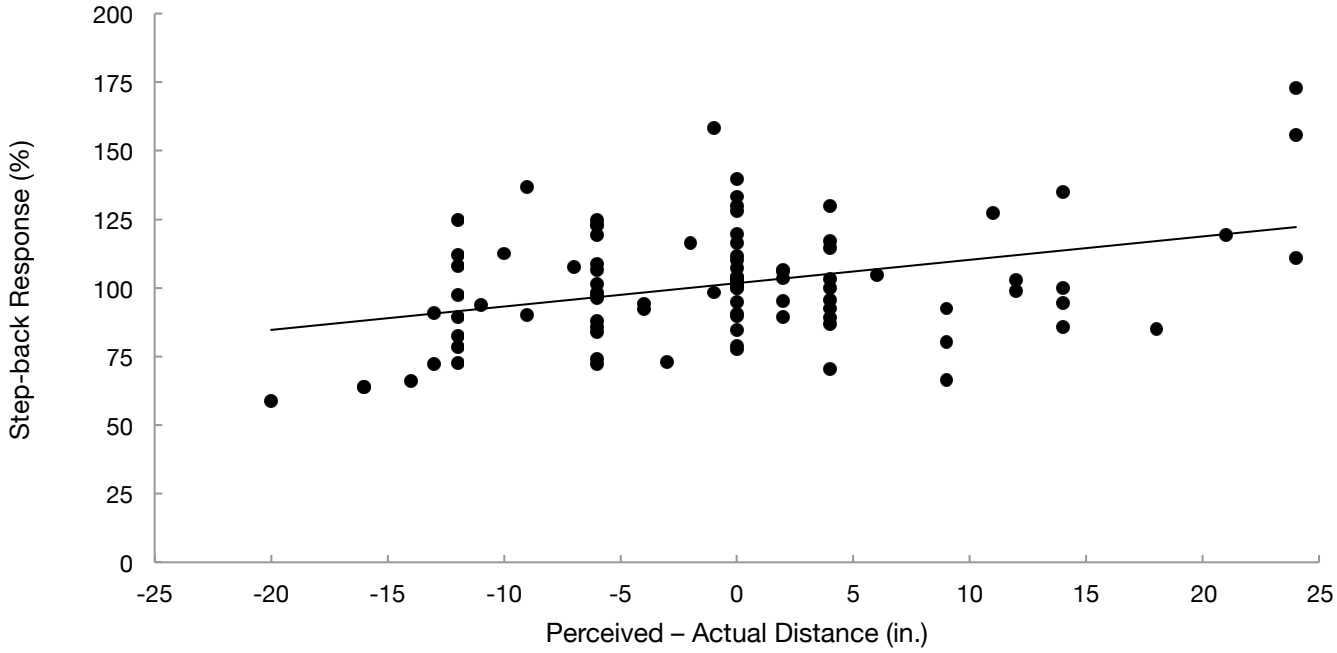

Figure 4. The scatter plot illustrates participants' step-back response after thirst (or thirst satiation) was induced (as a percentage of their baseline) in relation to their perceptual judgment accuracy for egocentric distance.

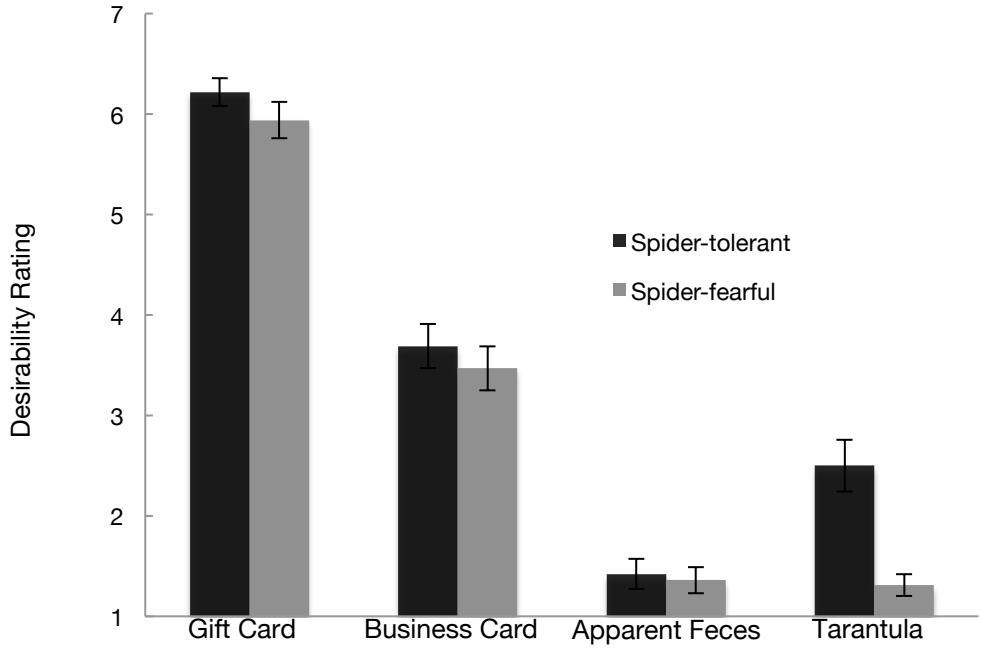

Figure 5. Mean desirability ratings (+/- 1 SEM) as a function of group and object. Ratings are based on a Likert scale, ranging from 1 (Very Undesirable) to 7 (Very Desirable).

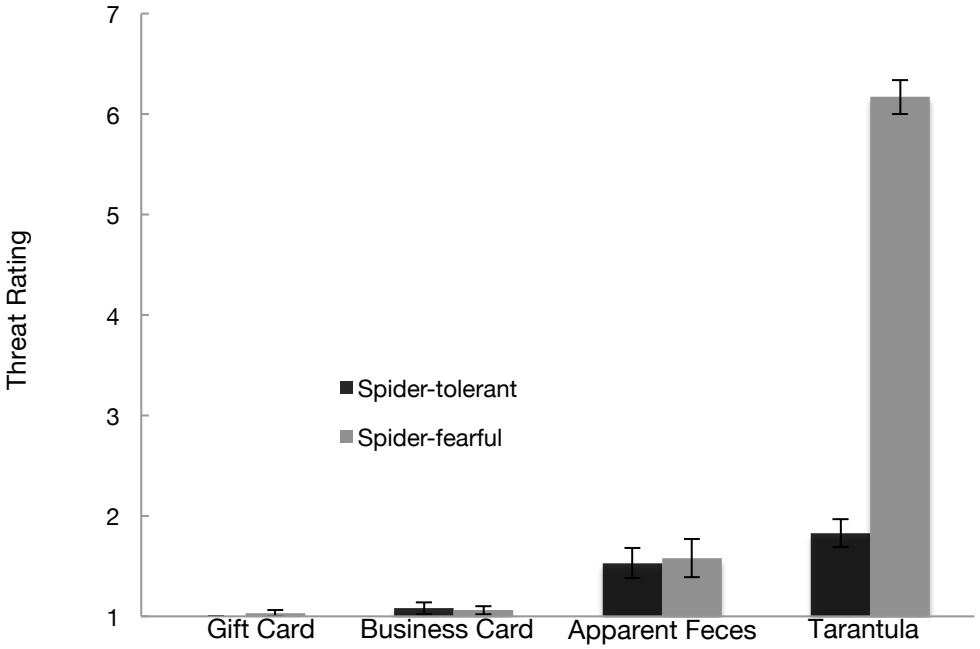

Figure 6. Mean threat ratings (+/- 1 SEM) as a function of group and object. Ratings are based on a Likert scale, ranging from 1 (Not at All) to 7 (Very Much So).

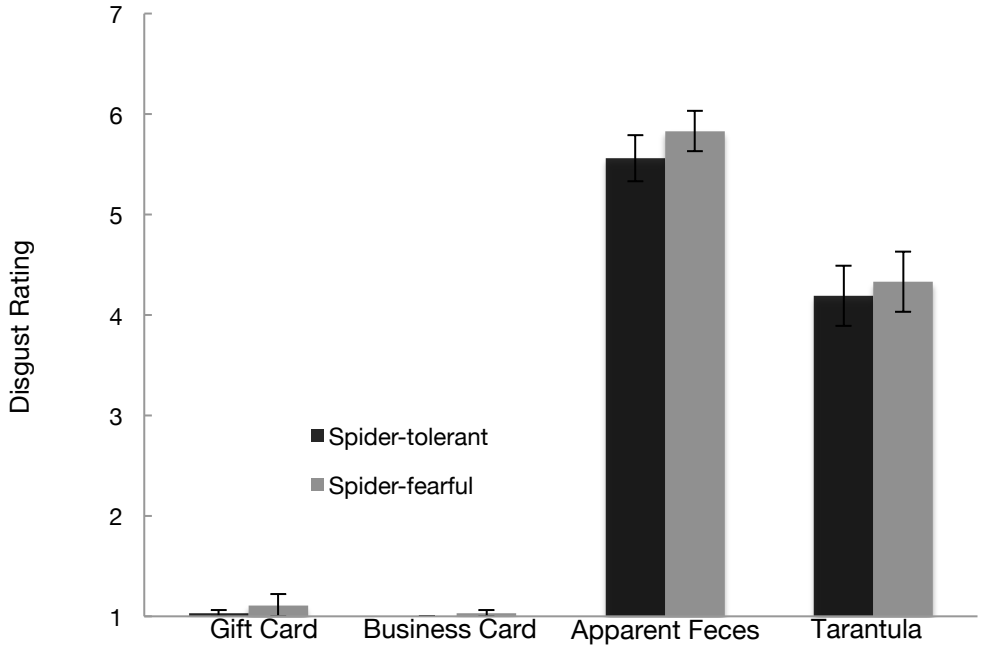

Figure 7. Mean disgust ratings (+/- 1 SEM) as a function of group and object. Ratings are based on a Likert scale, ranging from 1 (Not at All) to 7 (Very Much So).

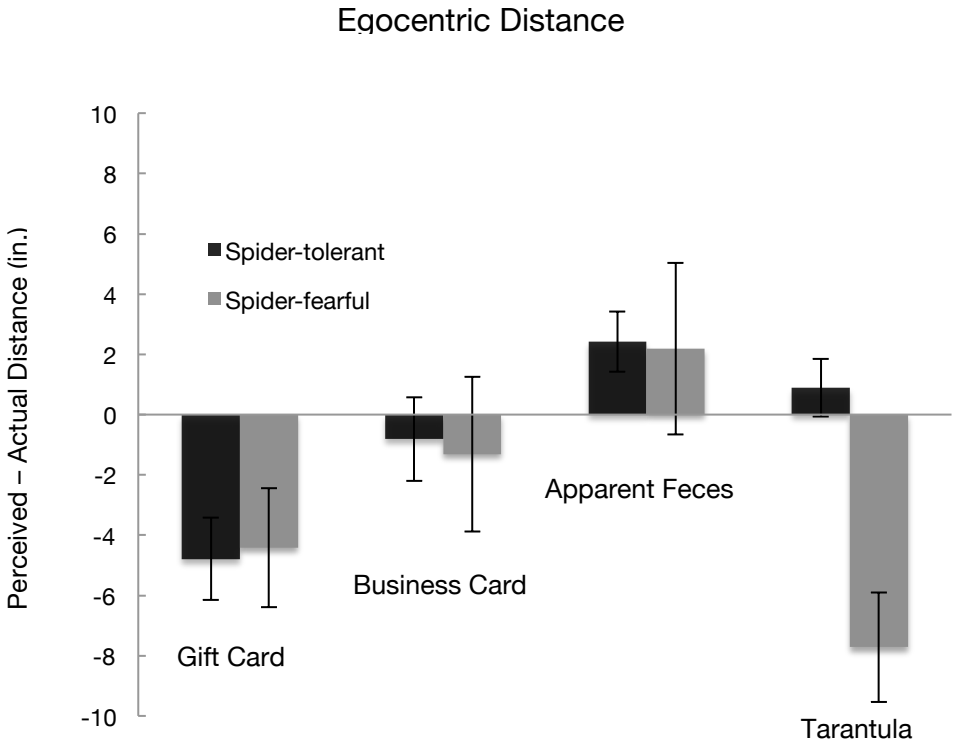

Figure 8. Mean perceptual judgment accuracy (+/- 1 SEM) for egocentric distance as a function of group and object.

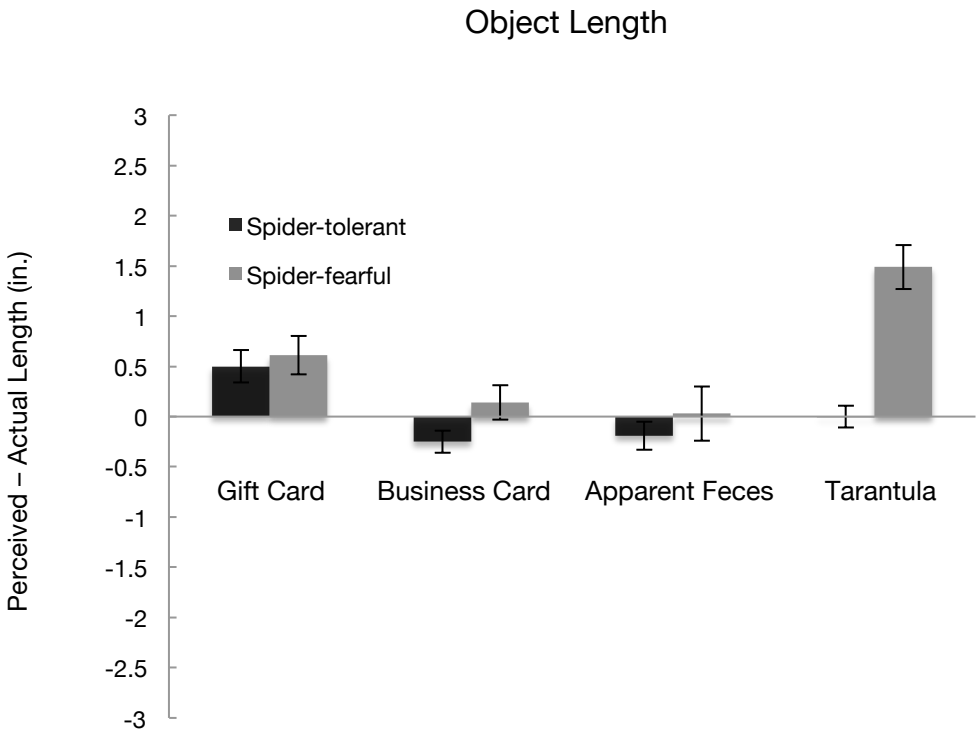

Figure 9. Mean perceptual judgment accuracy (+/- 1 SEM) for object length as a function of group and object.

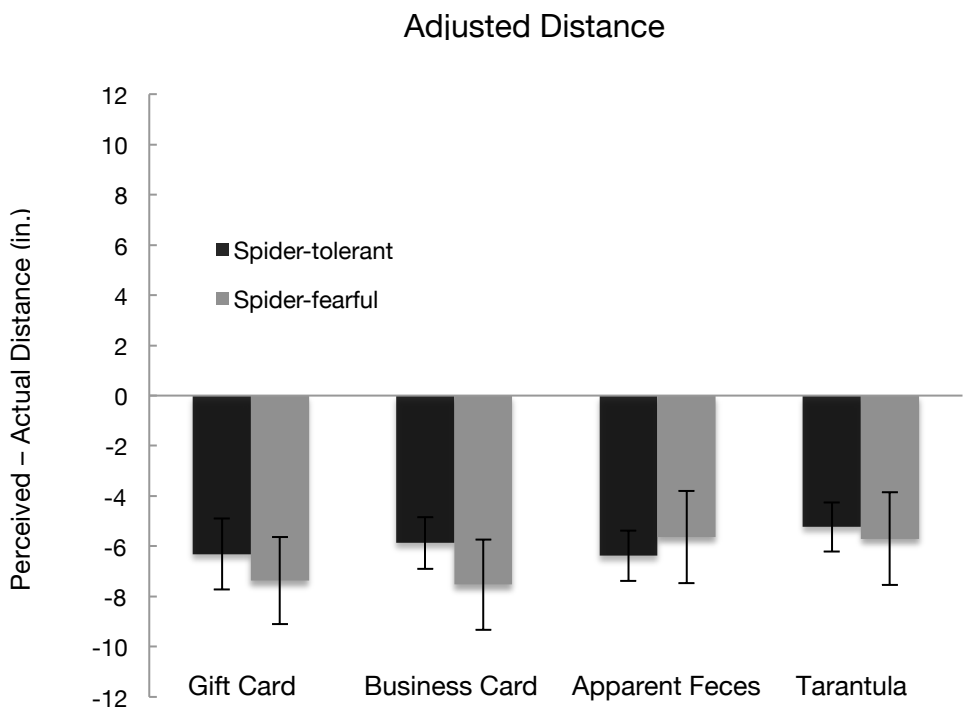

Figure 10. Mean perceptual judgment accuracy (+/- 1 SEM) for adjusted distance as a function of group and object.

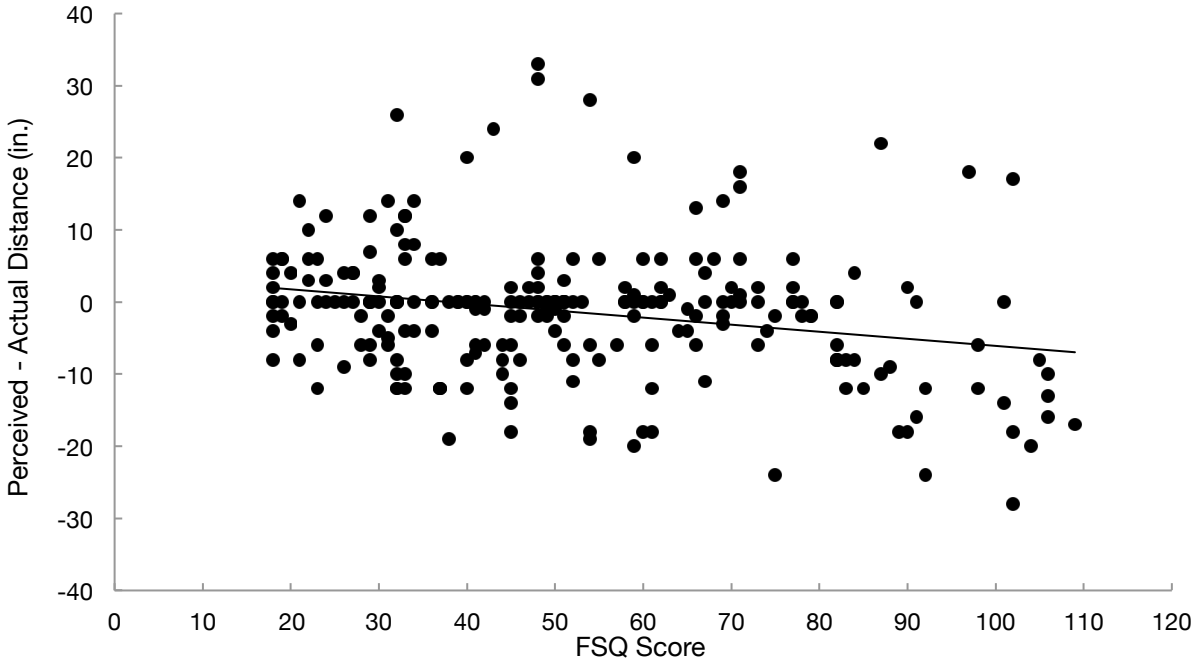

Figure 11. The scatter plot illustrates participants' perceptual judgment accuracy for egocentric distance to the contained tarantula in relation to their respective FSQ scores.

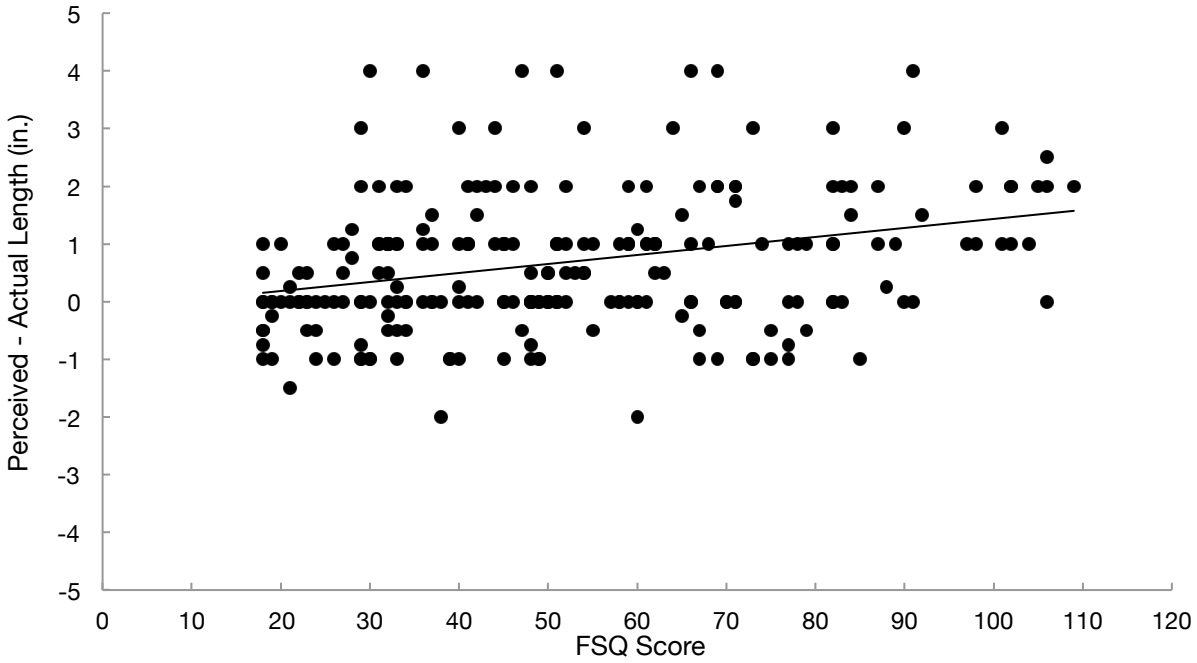

Figure 12. The scatter plot illustrates participants' perceptual judgment accuracy for length of the contained tarantula in relation to their respective FSQ scores.

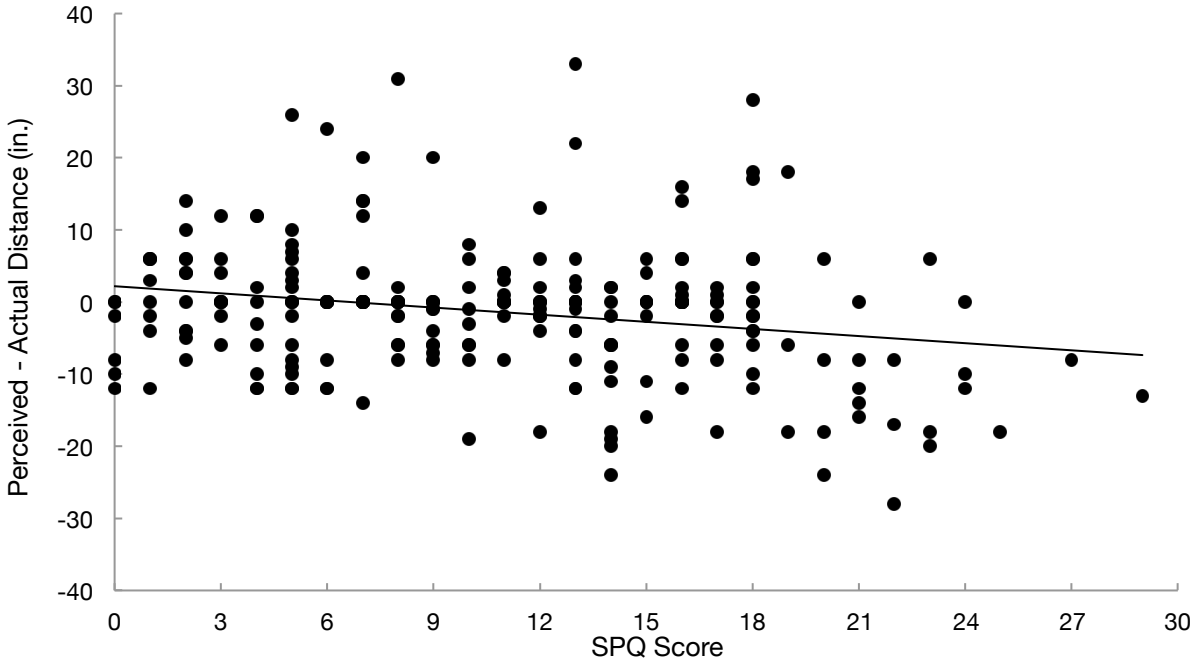

Figure 13. The scatter plot illustrates participants' perceptual judgment accuracy for egocentric distance to the contained tarantula in relation to their respective SPQ scores.

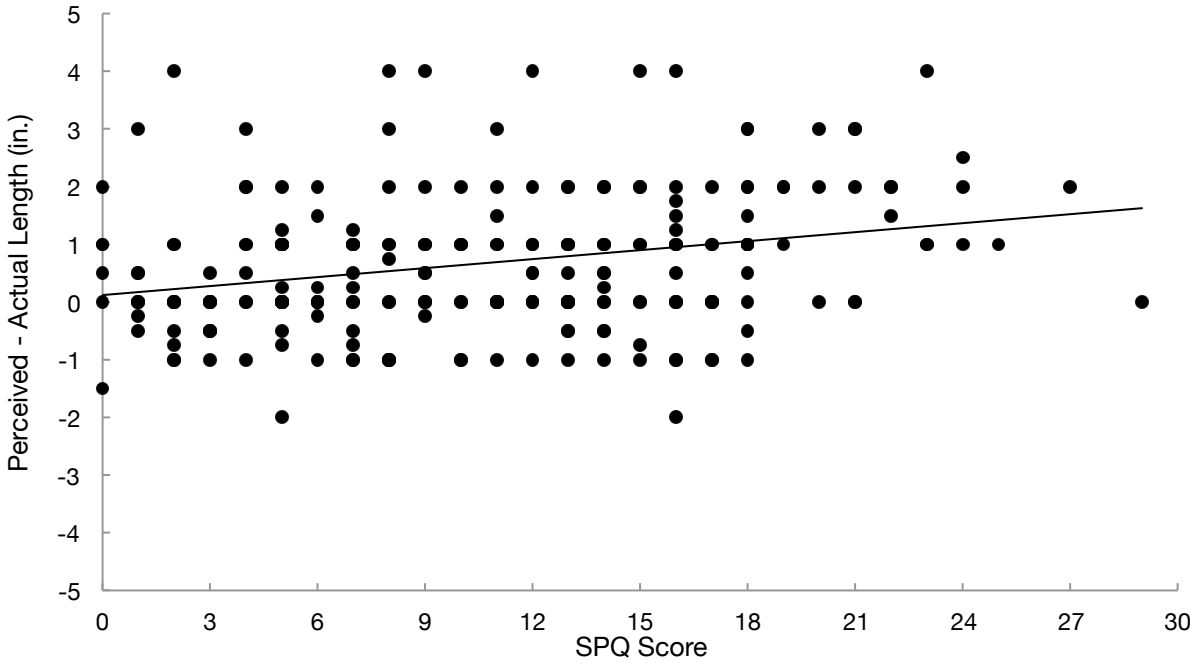

Figure 14. The scatter plot illustrates participants' perceptual judgment accuracy for length of the contained tarantula in relation to their respective SPQ scores.

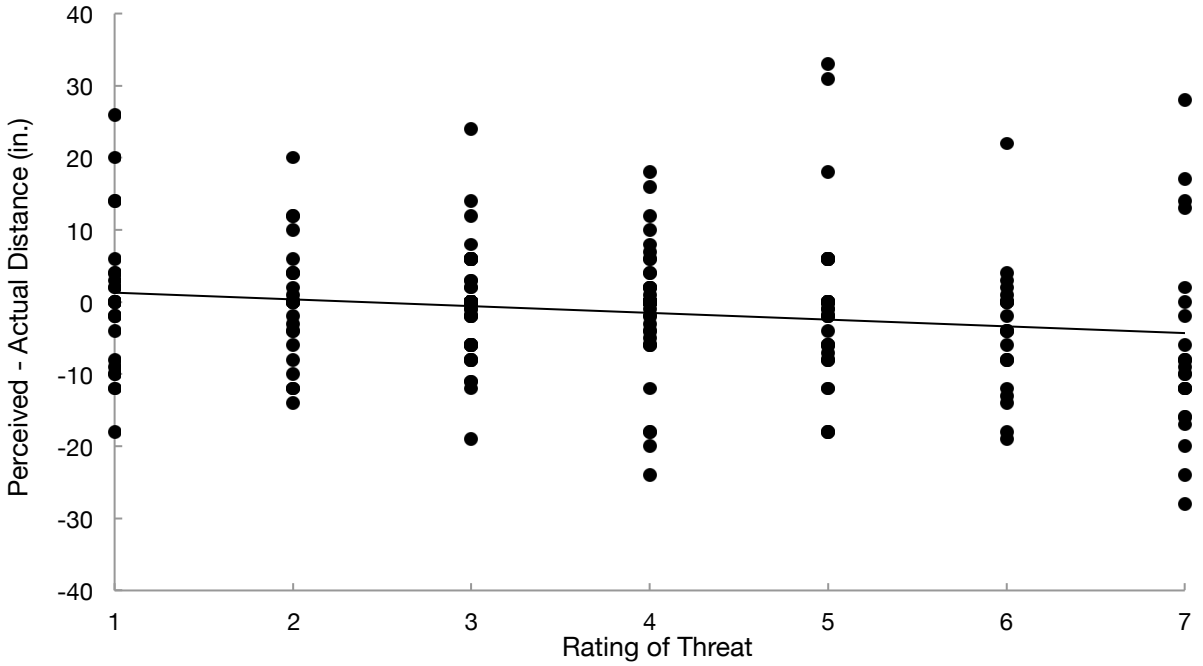

Figure 15. The scatter plot illustrates participants' perceptual judgment accuracy for egocentric distance to the contained tarantula in relation to their respective ratings of perceived threat on a 7-point Likert scale.

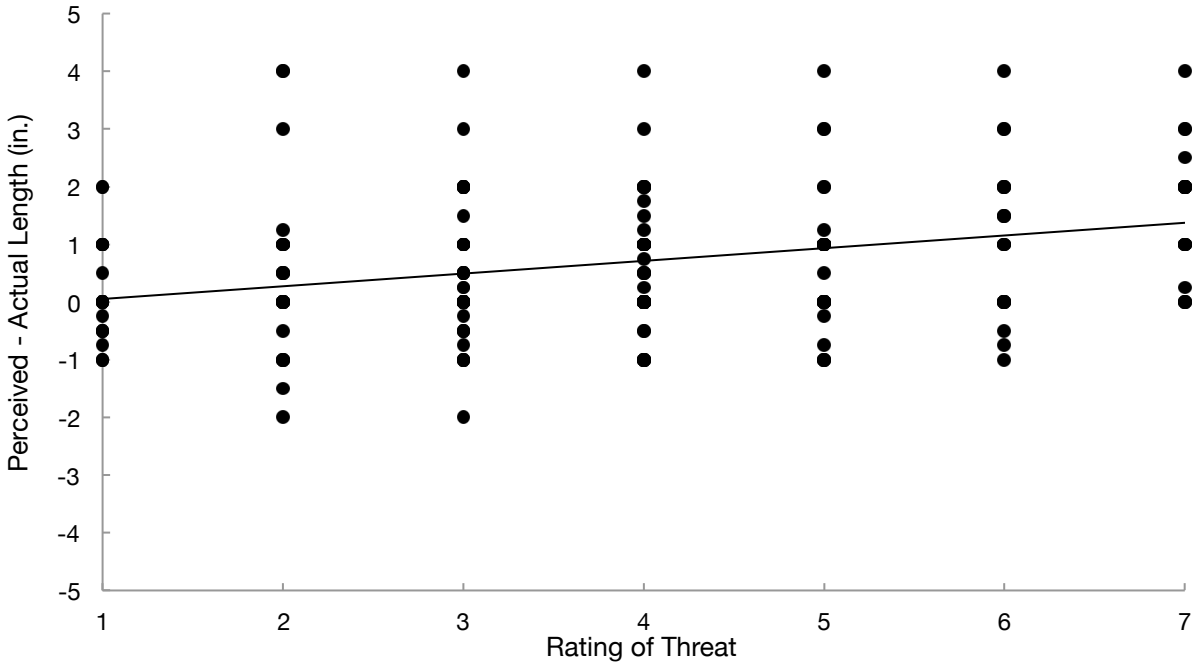

Figure 16. The scatter plot illustrates participants' perceptual judgment accuracy for length of the contained tarantula in relation to their respective ratings of perceived threat on a 7-point Likert scale.

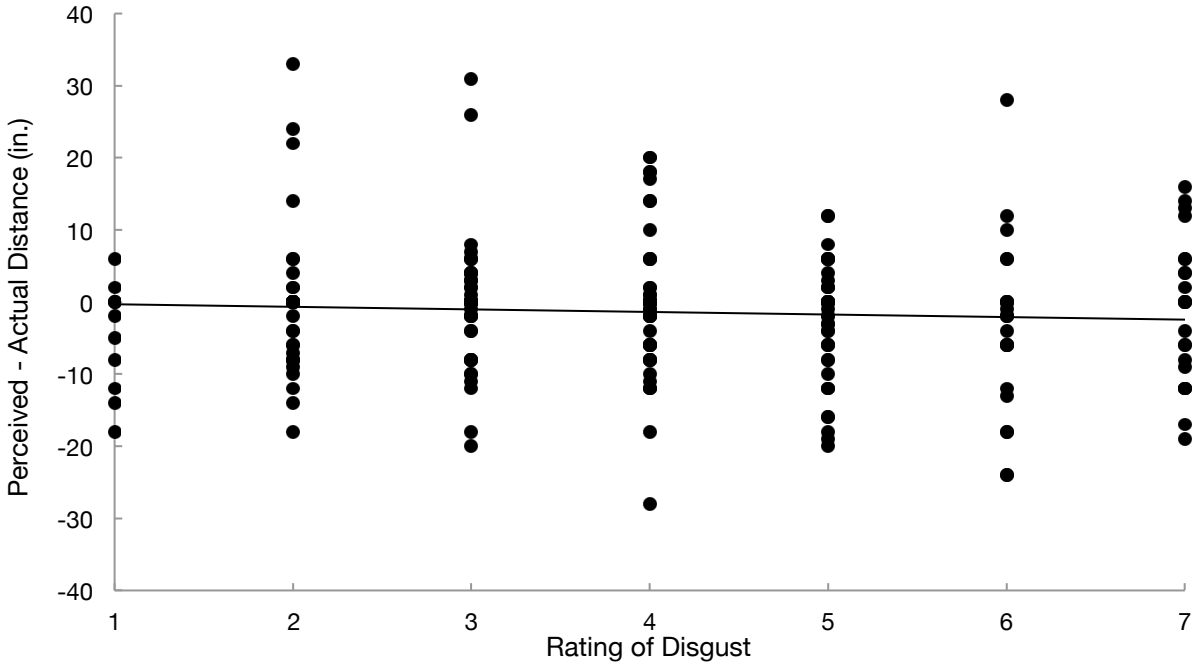

Figure 17. The scatter plot illustrates participants' perceptual judgment accuracy for egocentric distance to the contained tarantula in relation to their respective ratings of perceived disgust on a 7-point Likert scale.

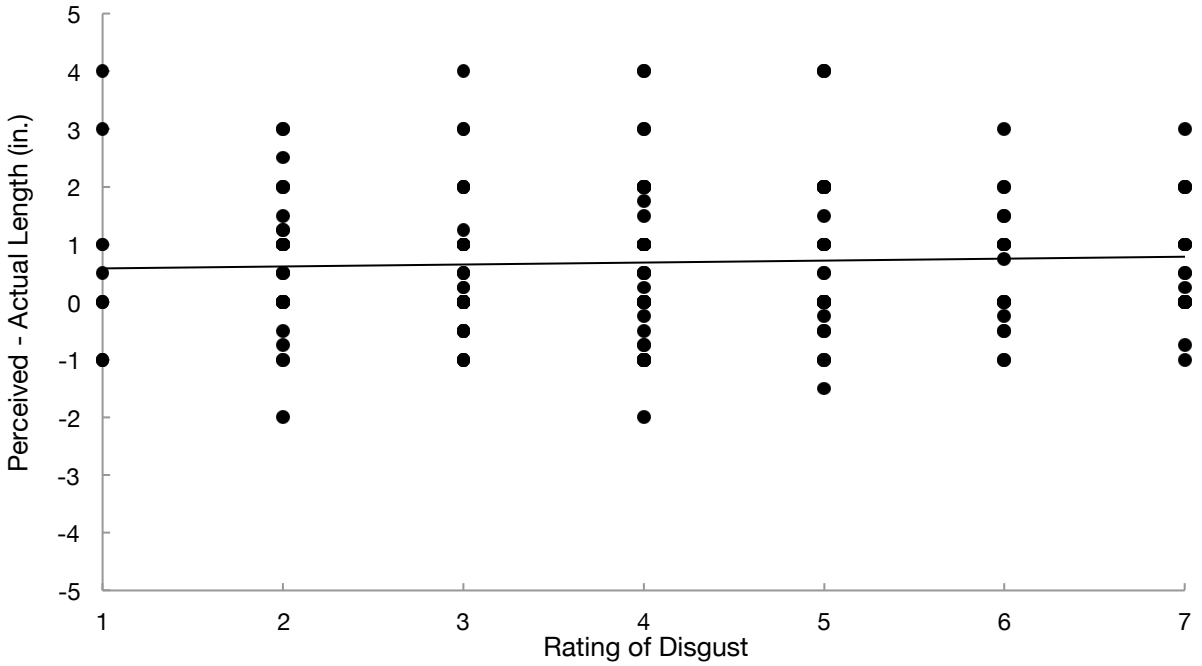

Figure 18. The scatter plot illustrates participants' perceptual judgment accuracy for length of the contained tarantula in relation to their respective ratings of perceived disgust on a 7-point Likert scale.

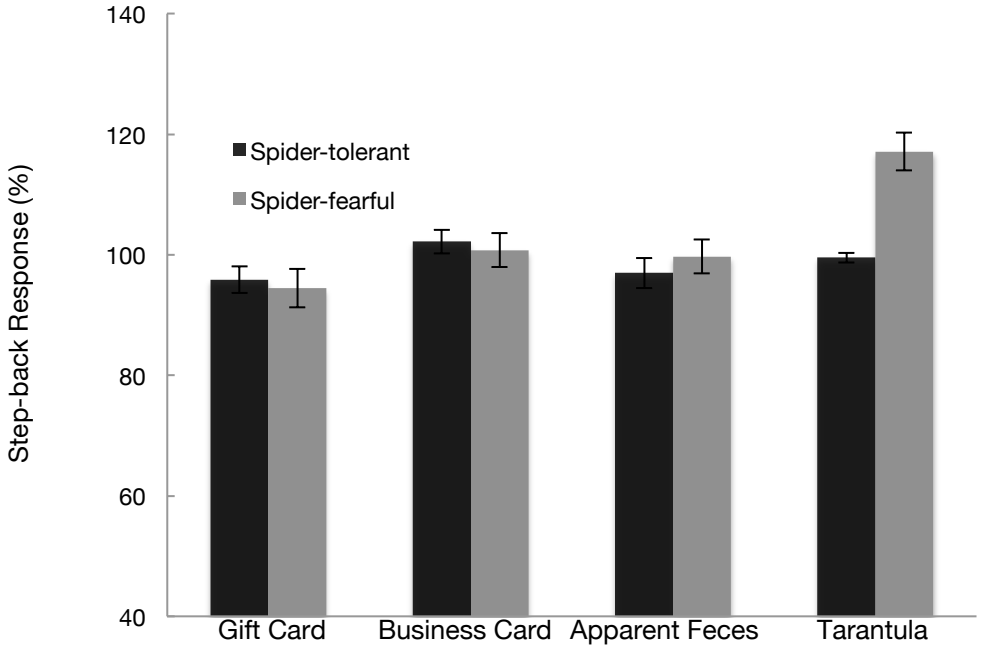

Figure 19. Mean step-back response (+/- 1 SEM) of spider-tolerant and spider-fearful individuals to each object as a percentage of their baseline.

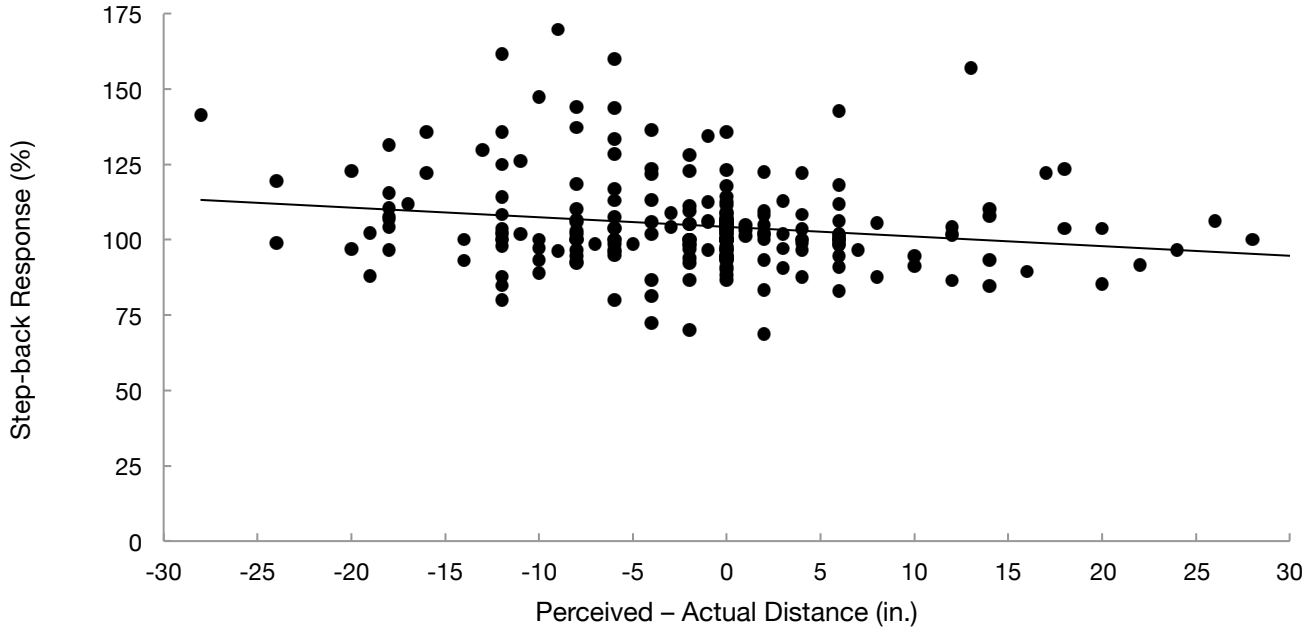

Figure 20. The scatter plot illustrates participants' step-back response to the contained tarantula (as a percentage of their baseline) in relation to their perceptual judgment accuracy for egocentric distance to the tarantula.

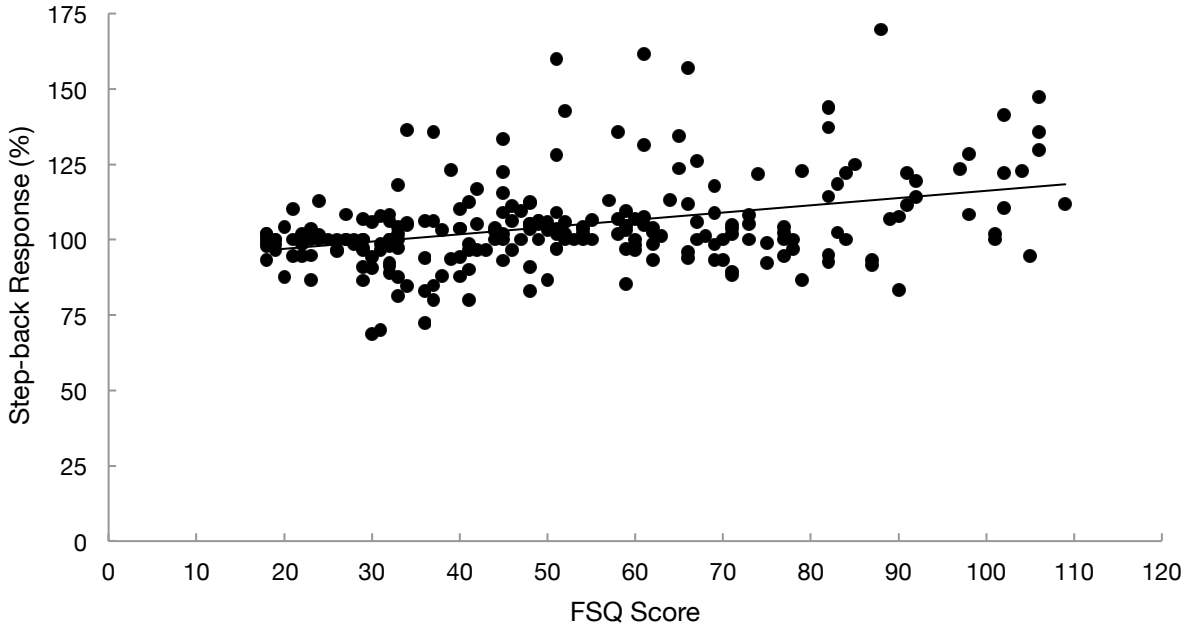

Figure 21. The scatter plot illustrates participants' step-back response to the contained tarantula (as a percentage of their baseline) in relation to their respective FSQ scores.

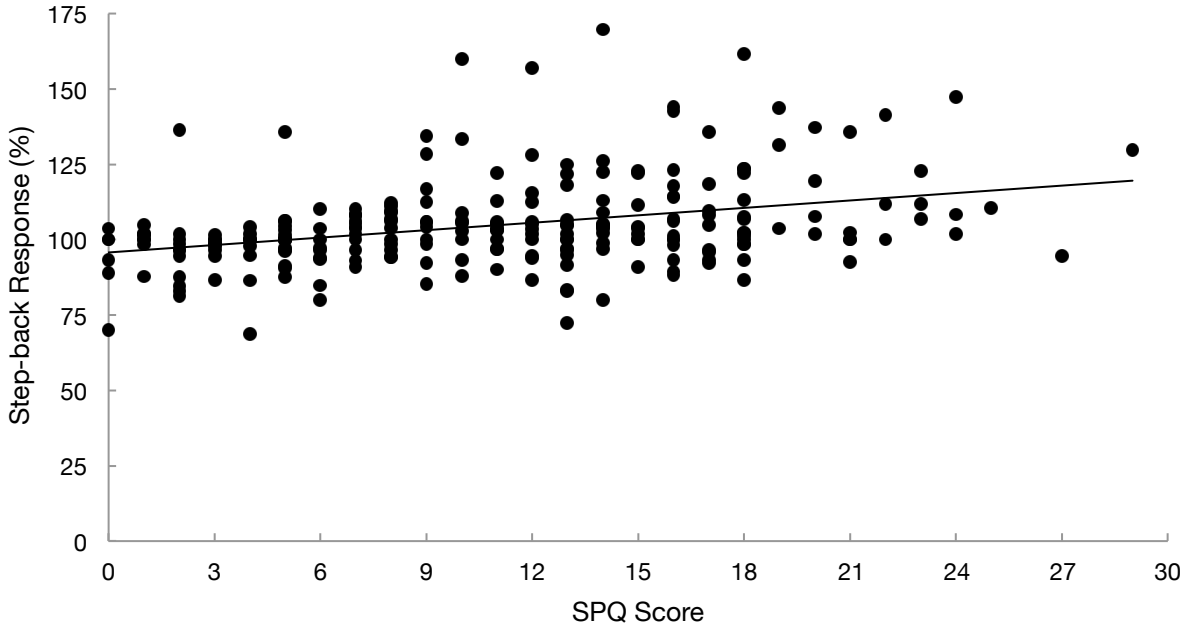

Figure 22. The scatter plot illustrates participants' step-back response to the contained tarantula (as a percentage of their baseline) in relation to their respective SPQ scores.

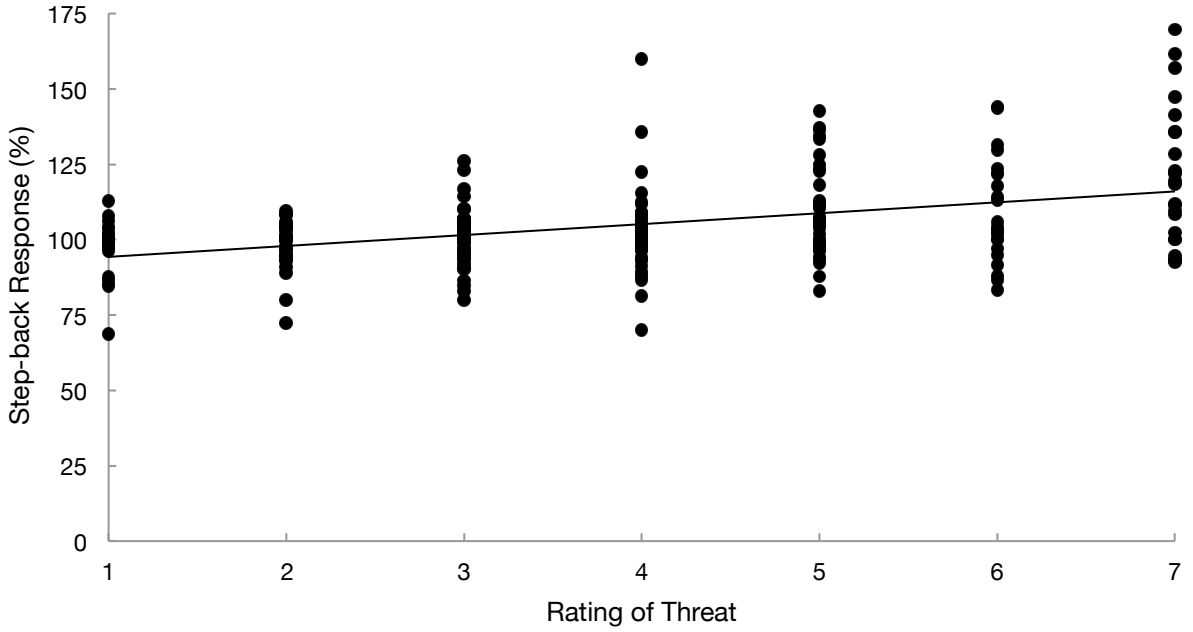

Figure 23. The scatter plot illustrates participants' step-back response to the contained tarantula (as a percentage of their baseline) in relation to their respective ratings of perceived threat on a 7-point Likert scale.

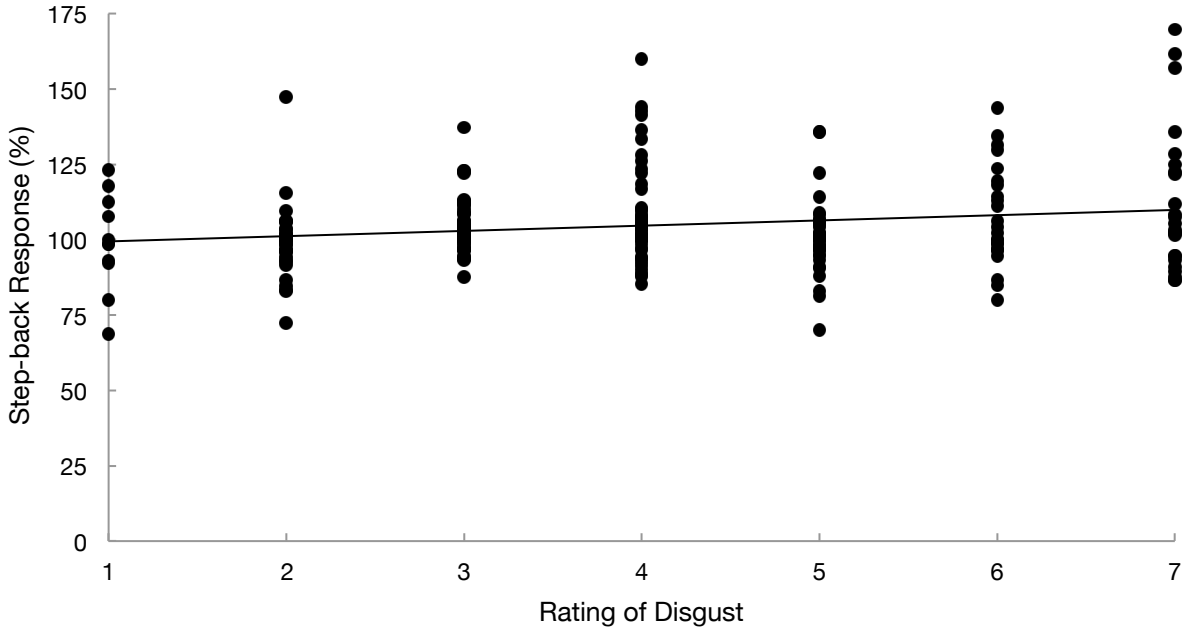

Figure 24. The scatter plot illustrates participants' step-back response to the contained tarantula (as a percentage of their baseline) in relation to their respective ratings of perceived disgust on a 7-point Likert scale.

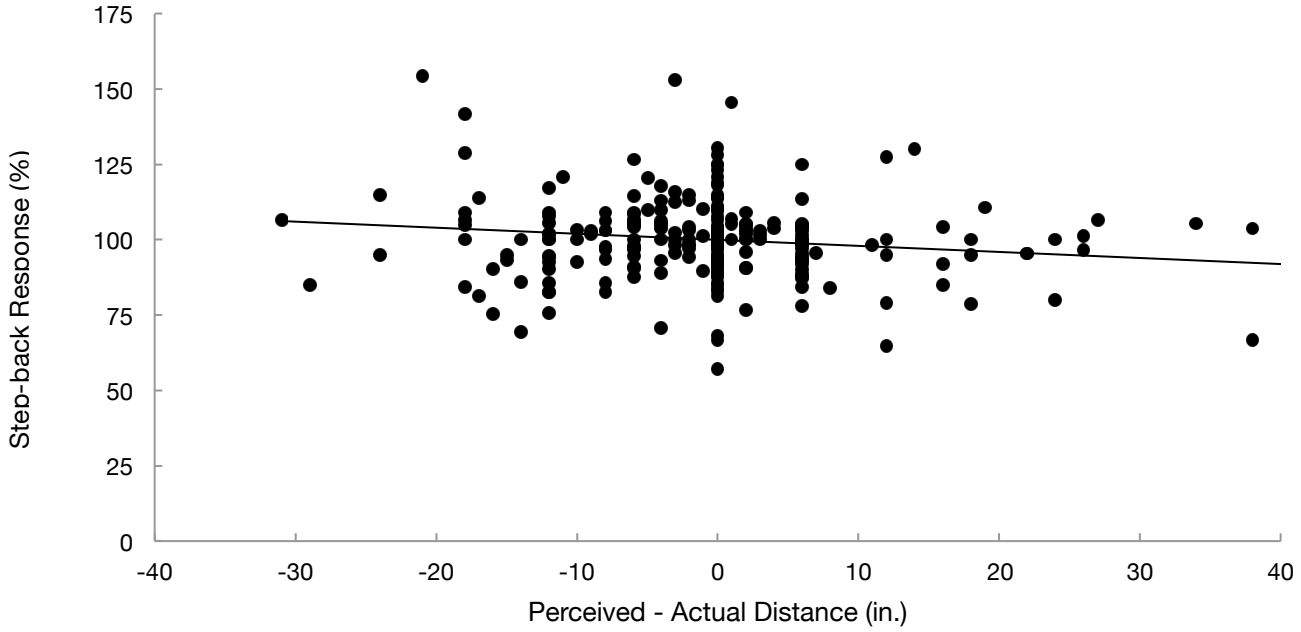

Figure 25. The scatter plot illustrates participants' step-back response to the business card (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for egocentric distance to the business card.

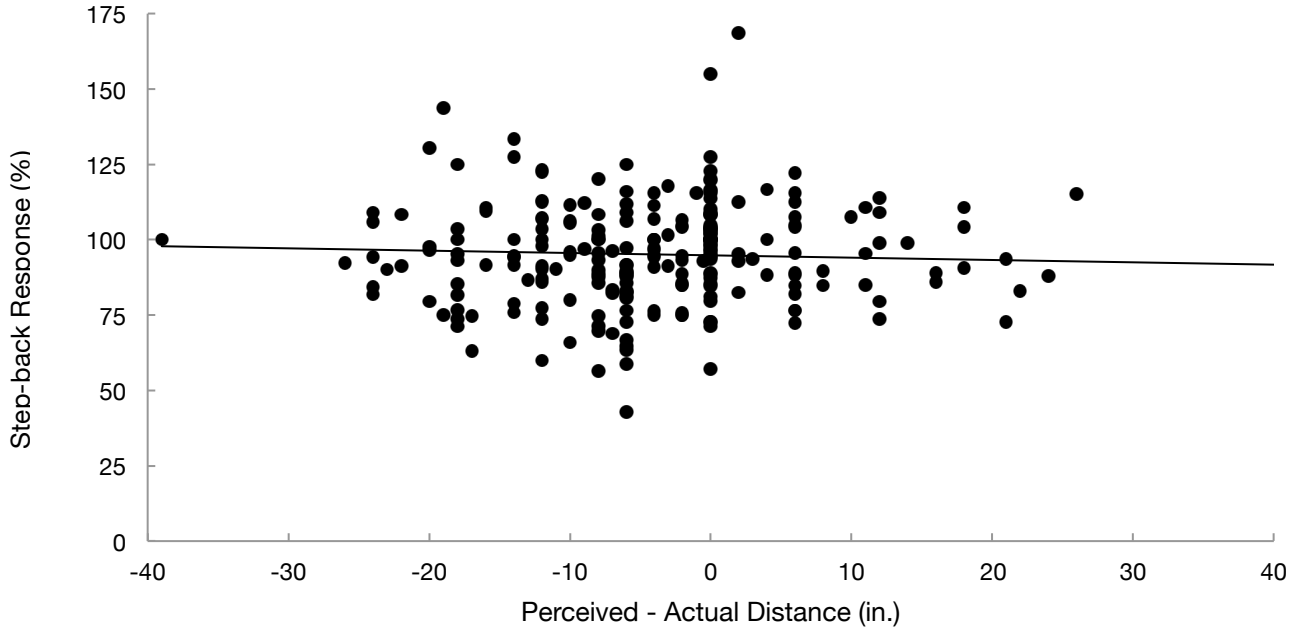

Figure 26. The scatter plot illustrates participants' step-back response to the gift card (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for egocentric distance to the gift card.

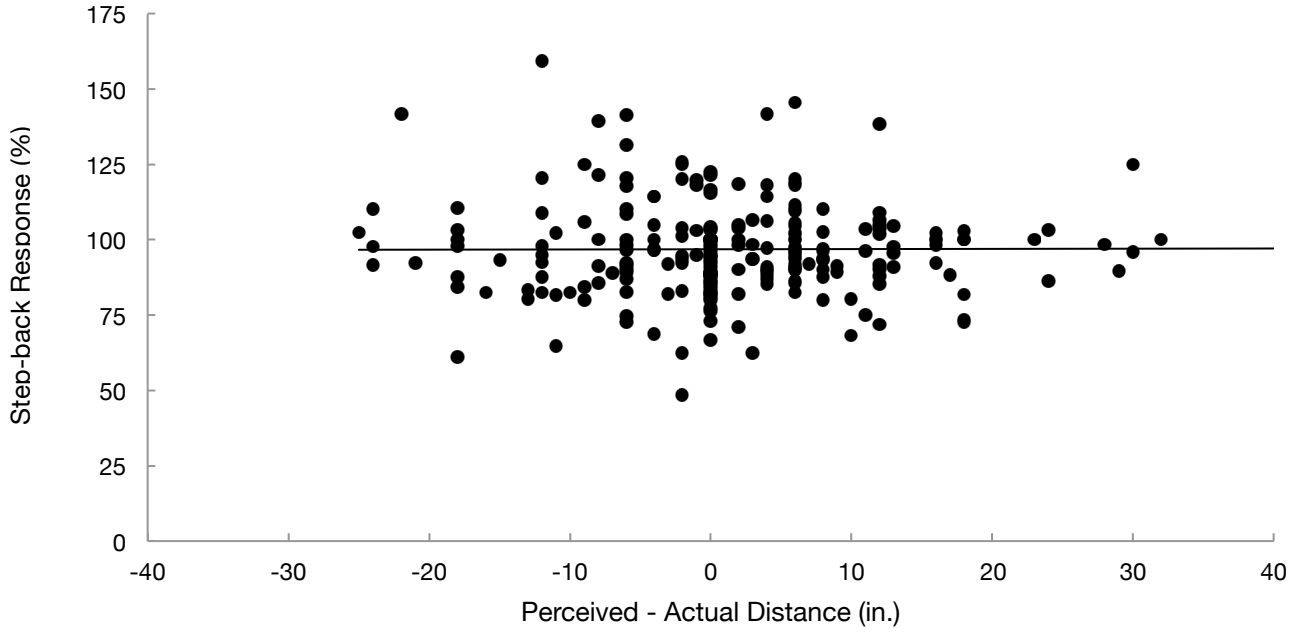

Figure 27. The scatter plot illustrates participants' step-back response to the apparent feces (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for egocentric distance to the apparent feces.

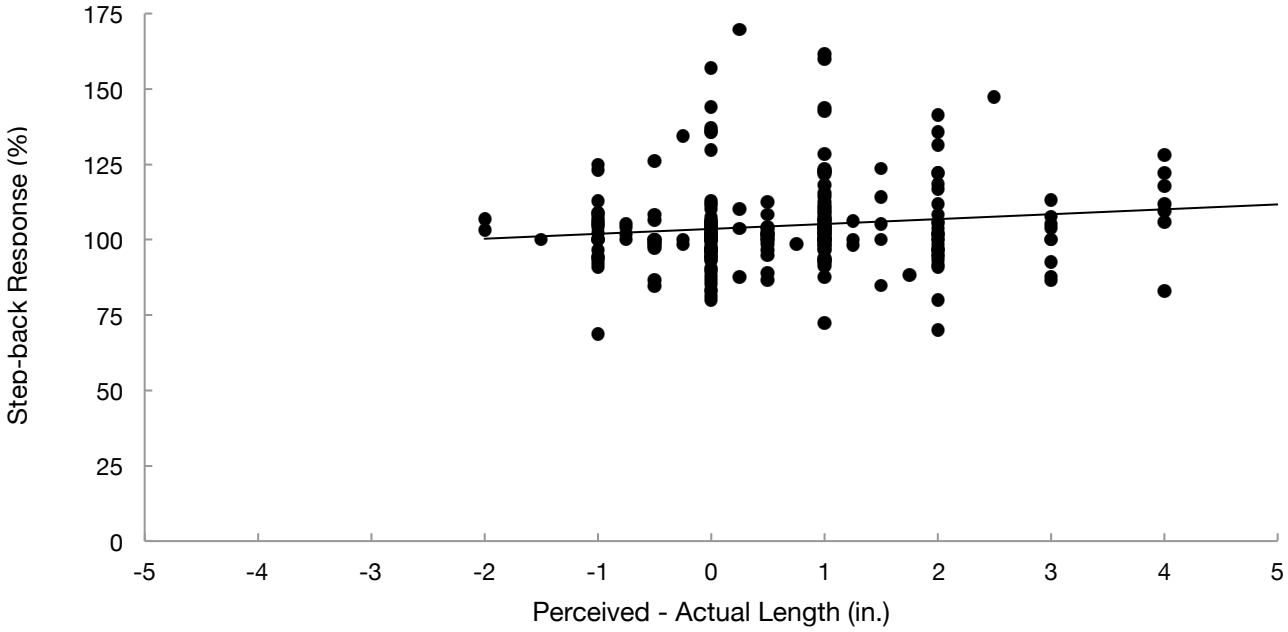

Figure 28. The scatter plot illustrates participants' step-back response to the contained tarantula (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for length of the contained tarantula.

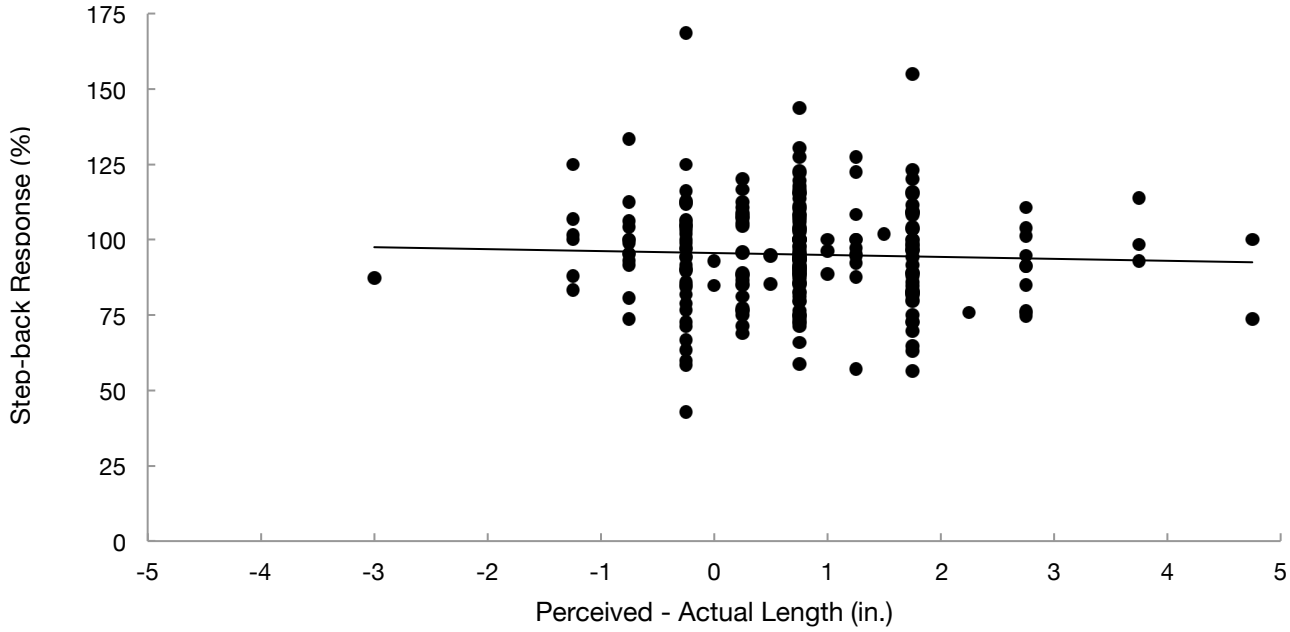

Figure 29. The scatter plot illustrates participants' step-back response to the gift card (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for length of the gift card.

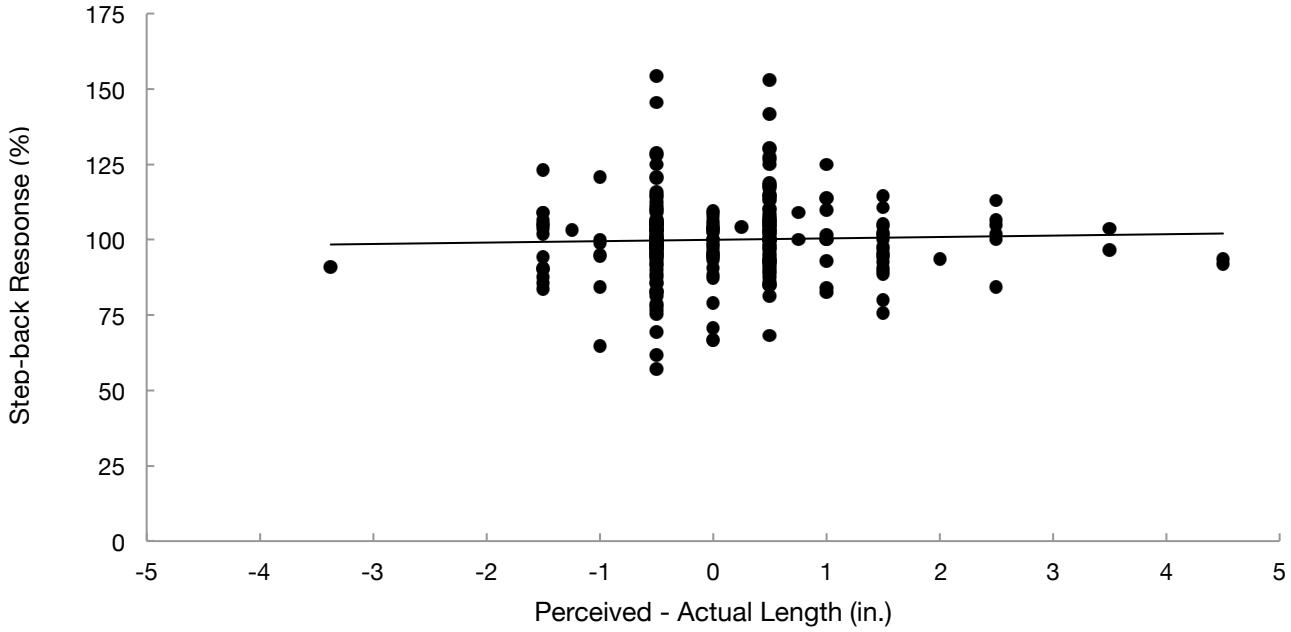

Figure 30. The scatter plot illustrates participants' step-back response to the business card (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for length of the business card.

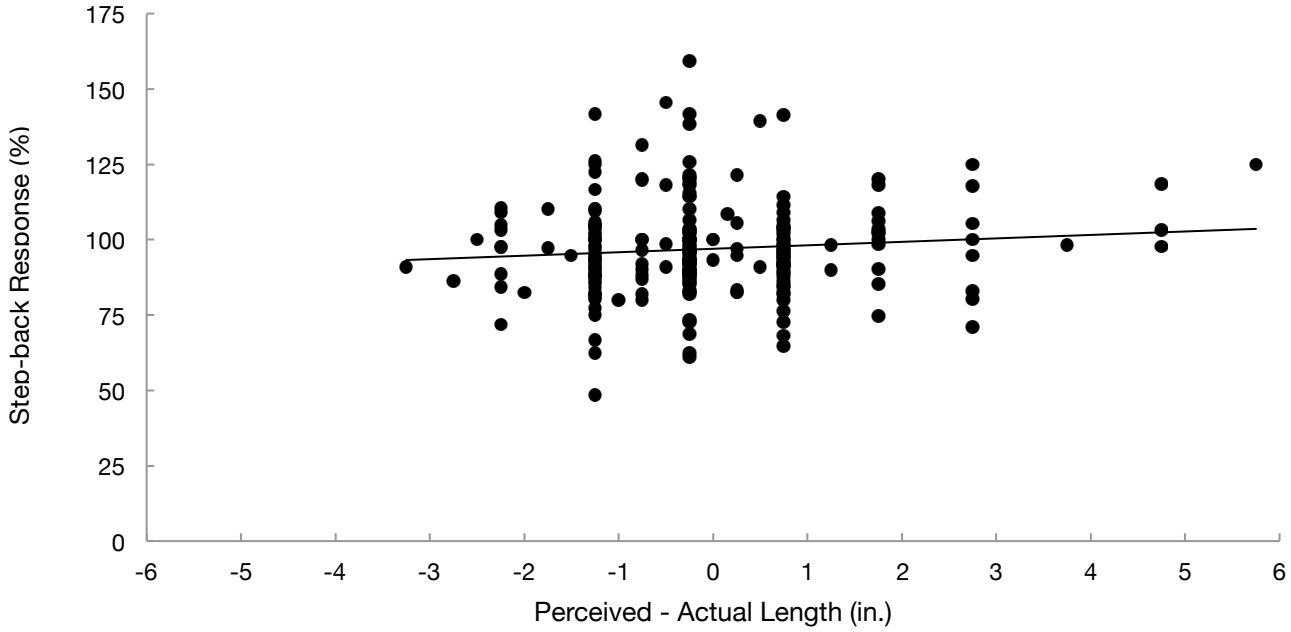

Figure 31. The scatter plot illustrates participants' step-back response to the apparent feces (as a percentage of their baseline) in relation to their respective perceptual judgment accuracy for length of the apparent feces.

Appendix A

Spider Questionnaire (SPQ)

Instructions: Answer each of the following statements either True or False as you feel they generally apply to you. If the statement is true most of the time or mostly true for you, you would answer **true**. If it is mostly false or false most of the time, mark it **false**. Indicate your answer by placing a mark (**X**) in the appropriate column.

TRUE	FALSE		
_____	_____	1.	I avoid going to parks or on camping trips because there may be spiders about.
_____	_____	2.	I would feel some anxiety holding a toy spider in my hand.
_____	_____	3.	If a picture of a spider crawling on a person appears on the screen during a motion picture, I turn me head away.
_____	_____	4.	I dislike looking at pictures of spiders in a magazine.
_____	_____	5.	If there is a spider on the ceiling over my bed, I cannot go to sleep unless someone kills it for me.
_____	_____	6.	I enjoy watching spiders build webs.
_____	_____	7.	I am terrified by the thought of touching a harmless spider.
_____	_____	8.	If someone says that there are spiders anywhere about, I become alert and on edge.
_____	_____	9.	I would not go down to the basement to get something if I thought there might be spiders down there.
_____	_____	10.	I would feel uncomfortable if a spider crawled out of my shoe as I took it out of the closet to put it on.
_____	_____	11.	When I see a spider, I feel tense and restless.
_____	_____	12.	I enjoy reading articles about spiders.
_____	_____	13.	I feel sick when I see a spider.
_____	_____	14.	Spiders are sometimes useful.
_____	_____	15.	I shudder when I think of spiders.
_____	_____	16.	I don't mind being near a non-poisonous spider is there is someone there in whom I have confidence.
_____	_____	17.	Some spiders are very attractive to look at.
_____	_____	18.	I don't believe anyone could hold a spider without some fear.
_____	_____	19.	The way spiders move is repulsive.
_____	_____	20.	It wouldn't bother me to touch a dead spider with a long stick.
_____	_____	21.	If I came upon a spider while cleaning the attic I would probably run.
_____	_____	22.	I'm more afraid of spiders than any other animal.
_____	_____	23.	I would not want to travel to Mexico or Central America because of the greater prevalence of tarantulas.
_____	_____	24.	I am cautious when I buy fruit because bananas may attract spiders.

_____	_____	25.	I have no fear of non-poisonous spiders.
_____	_____	26.	I wouldn't take a course in biology if I thought I might have to handle live spiders.
_____	_____	27.	Spider webs are very artistic.
_____	_____	28.	I think that I'm no more afraid of spiders that the average person.
_____	_____	29.	I would prefer not to finish a story if something about spiders was introduced into the plot.
_____	_____	30.	Even if I was late for a very important appointment, the thought of spiders would stop me from taking a shortcut through an underpass.
_____	_____	31.	Not only am I afraid of spiders, but millipedes and caterpillars make me feel anxious.

Appendix B

FSQ

Instructions: Rate to what extent you now believe that the following statements are characteristic of your feelings, thoughts, and behaviors towards spiders.

1. If I came across a spider now, I would get help from someone else to remove it.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

2. I sometimes now am on the look out for spiders.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

3. If I saw a spider now, I would think it will harm me.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

4. I now think a lot about spiders.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

5. I would be somewhat afraid to enter a room now, where I have seen a spider before.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

6. I now would do anything to try to avoid a spider.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

7. I sometimes now think about getting bit by a spider.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

8. If I encountered a spider now, I wouldn't be able to deal effectively with it.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

9. If I encountered a spider now, it would take a long time to get it out of my mind.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

10. If I came across a spider now, I would leave the room.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

11. If I saw a spider now, I would think it will try to jump on me.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

12. If I saw a spider now, I would ask someone else to kill it.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

13. If I encountered a spider now, I would have images of it trying to get me.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

14. If I saw a spider now I would be afraid of it.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

15. If I saw a spider now, I would feel very panicky.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

16. Spiders are one of my worst fears.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

17. I would feel very nervous if I saw a spider now.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree

18. If I saw a spider now I would probably break out in a sweat and my heart would beat faster.

1	2	3	4	5	6	7
Strongly disagree			Agree			Strongly agree