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When feeling is for seeing: Comparing the effects of motivated perception between fear and anger on ambiguous threatening stimuli

Aurélien Graton¹

Hélène Fezzi¹

Noémie Le Jeune¹

¹Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, LIP/PC2S, Grenoble, France

Correspondence concerning this article can be addressed to:

Aurélien Graton

LIP / PC2S

Université Savoie Mont-Blanc

UFR LLSH

Domaine Universitaire de Jacob Bellecombette

73011 Chambéry Cedex

France

e-mail : aurelien.graton@univ-smb.fr

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Author contribution

Aurélien GRATON conceived the study, developed the theory, verified the analytical method and statistics, conducted the second study and wrote the article. Noémie LE JEUNE and Hélène FEZZI fabricated the material, conducted the first study and did preliminary statistics.

Abstract

We do not see the world as it is: distortions of visual perception can occur depending on the goals we wish to achieve (“wishful seeing”). Following functionalist theories of emotions (e.g. "feeling is for doing"), visual perception biases could also be involved in the link between emotion and specific behavior. Previous research has shown that anger can modify visual perception towards ambiguous menacing stimuli, or that fear can similarly direct our attention and perception towards threatening stimuli (e.g. weapons). The aim of our research was to replicate these effects by directly comparing the effects of these two emotions on perceptual biases and by relying on general mixed models to control Type I errors and reduce the risk related to the non-independence between observations. Our results partially replicate a perceptual bias toward threatening objects for both emotions although this effect depends on the type of stimulus and of the emotional dimension involved. These results are discussed in terms of the impact of emotions in attentional and perceptual processes and in relation to alternative theoretical explanations for motivated perception.

Key words: Wishful Seeing, Emotion, Anger, Fear, Motivated Perception

When feeling is for seeing: Comparing the effects of motivated perception between fear and anger on ambiguous threatening stimuli

Introduction

It is widely accepted that emotions are used to guide our behavior (Frijda, 1986; Zeelenberg & Pieters, 2006). If I am afraid, I will tend to run away. Similarly, anger is generally associated with aggressive behavior (Anderson & Huesmann, 2007; Buss & Perry, 1992; Novaco, 2007). The last few decades have thus been marked by the development of emotion theories that include behavior as part of the very definition of emotion (e.g., Frijda, 1986; Roseman, Wiest, & Schwarz, 1994; Scherer, 1984). Emotional experience is not restricted to the evaluation of a situation leading to a change in physiological state or cognition, it allows the preparation of a behavioral response. More precisely, it is now suggested that specific emotions prepare for specific behaviors ("feeling is for doing", see Zeelenberg et al., 2008). Recent research is now increasingly focused on investigating the cognitive processes that explain this link between emotion and behavior. For example, it has been shown that attention can be modified by emotions in order to accomplish a goal: disgust evoked early attention towards stimuli related to cleanliness (Vogt et al., 2011), while guilt generated attentional biases towards stimuli related to "reparation" (Graton & Ric, 2016).

In this context, motivation to perform a certain behavior associated with a specific emotion may cause other cognitive mechanisms to change in order to be able to perform that behavior. In this way, research has found that anger can change our perception of a threatening object: participants with whom the emotion of anger had been induced demonstrated a bias on a threat detection task (Baumann & DeSteno, 2010). Other emotions are likely to activate similar perception biases. In order to prepare for flight or another response, fear should also logically motivate a perceptual bias toward greater perception of threat-related stimuli (Baumann & DeSteno, 2010 ; Van Bockstaele et al., 2014). However,

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although the effects of motivated perception are quite robust and well documented (see Cole & Balcetis, 2021 for a review), several questions remain when it comes to the effects on these emotions.

First, if the effects of anger on motivated perception have been shown, those concerning fear remain less well known, and no direct comparison between the two emotions has been made. The previous experiments were also based on statistical models that did not always take into account the non-independence between the observations, creating risks of type I error as well as the impossibility of generalizing the results to other stimuli. Finally, the different dimensions of emotions, in particular cognitive and affective, were not always distinguished in the effects. The aim of the present research was therefore to replicate the effects of anger on perceived motivation, comparing them to those of fear, using general mixed models to help generalization and comparing the effects of emotional groups to those of the amount of emotion reported by the participants (reported feelings).

Motivation and perceptual distortion

Individuals generally think that they perceive the world as it is (Dunning & Balcetis, 2013). However, our capacity for visual perception is limited, and early research has looked at the possibility of modulating our visual states according to our interests and internal states (e.g., Bruner, 1957; McGinnes, 1949). These "wishful seeing" experiences have been deepened and detailed in more recent research streams, and a series of studies conducted since the beginning of the 21st century has stressed that individual preferences and motivation lead to changes in our perceptual experiences (Balcetis & Dunning, 2006; Proffitt, 2006; Proffitt et al., 2003; Riener, Stefanucci, & Proffitt, 2003). These changes in visual perception are of two types: a first category concerns the categorization of objects of an "ambiguous" nature, and another category concerns the perception of our environment. With respect to the categorization of objects, Balcetis and Dunning (2006) showed for instance that an ambiguous

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stimulus that could be perceived as either a "B" or the number "13" was identified as one or the other by participants based on their interest (e.g., an associated reward). Concerning the representation of our environment, other studies have shown that the perception of the distance of an object can be modified according to the desirability assigned to that object (Proffitt, 2006). Similarly, certain individual characteristics (age, fatigue) lead to the perception of objective physical dimensions (e.g., the slope of a hill) as more or less important depending on these characteristics (Proffitt et al., 2003).

Why these perceptual distortions? One of the main reasons given is that wishful seeing is a way of helping people achieve their goals, thus meeting an adaptive need. The observed effects of wishful seeing would thus be directly related to our motivation to accomplish specific actions. For example, thirsty people perceived a filled bottle of water to be larger (Veltkamp, Aarts, & Custers, 2008), which may allow them to see (and therefore use) it more quickly than when they are not thirsty. Numerous studies have replicated these effects in everyday situations (sport, food...) and seem to provide a solid basis as well as quite large effect sizes to these motivated perception effects (e.g., Block, 2023 ; Schnall, Zadra, & Proffitt, 2010; Taylor, Witt & Sugovic, 2011; Wesp et al., 2004 ; Witt, Shuck, & Taylor, 2011). A conception of emotions as directing our motivation towards specific actions should therefore lead, in the same direction, to a modification of our visual perception aimed at accomplishing these behaviors.

However, the theoretical contours of distorted perception have recently been called into question (de Carvalho, 2022; Firestone, 2013; Firestone & Scholl, 2014) and alternative explanations to an exclusive effect of motivated perception have been proposed. Firestone in particular has argued that the visual distortion effects observed may be due more to "non-perceptual" biases than to what he has termed a "paternalistic" conception of vision consisting of helping individuals in the pursuit of adaptive tasks and behaviors. Other biases such as

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experimental demand could thus be involved, modifying our judgment rather than our actual physical perception of the environment (Firestone, 2013). While the initial aim of our research was not to empirically decide in favor of one approach or another, these alternative explanations will be discussed further in the light of what they imply in the emotional domain.

From motivated perception to emotions

It is now commonly accepted that emotions are used to mobilize cognitive abilities towards a specific goal at a given time by "prioritizing" certain objectives over others (Bagozzi et al., 2000; Frijda, 1986; Pieters & Van Raaji, 1988). The "feeling is for doing" approach (Zeelenberg & Pieters, 2006) synthesizes this motivational conception. The authors give the example of fear, which will create a priority to flee in the face of a threatening stimulus, or guilt, which increases pro-social behaviors (Zeelenberg et al., 2008, see also Ketelaar & Au, 2003). The characteristic of the "feeling is for doing" approach and more generally of motivational theories of emotions is to associate specific actions with emotions. The behavioral response of an emotion cannot be reduced to valence, as two negative emotions can trigger very different behavioral tendencies (e.g., flight for fear, reparation for guilt). Each specific emotion will thus serve different motivational purposes. It should be noted that these behavioral tendencies will be observed both in the case of "integral" emotions (i.e., the emotional experience is directly related to the goal) or "incidental" emotions (i.e., the emotional experience is external). Current research is now focusing on better understanding these specific links between emotions and actions. In other words, it is "time to move beyond the mere documentation of behavioral results of emotions to direct tests of the proposed mechanism underlying these effects" (Zeelenberg et al., 2008, p. 24).

Visual distortion to reach an emotional goal

Among these intermediate processes, some studies have, for example, looked at possible attentional biases caused by emotions. Research in this area has previously focused

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on showing that certain affects led to increased attention to stimuli related to the source of the emotion, such as negative stimuli or stimuli associated with the notion of threat for people experiencing anxiety (Fox, 2002; Mogg & Bradley, 2005; Williams et al, 1988). In the field of visual perception, it has been shown that fear modified the perception of distance from threatening objects such as spiders (Cole, Balcetis, & Dunning, 2013) or that people afraid of falling saw the distance to the ground as greater than those who were unafraid when they stood on a balcony (Stefanucci & Proffitt, 2009). Within the framework of an action-oriented conception of emotion, it was likewise conceivable that an emotional state also directs towards the means available to prepare this action. Research has for instance shown that disgust increased attention to stimuli related to cleanliness (Vogt et al., 2011) or that guilt created more attention to stimuli related to repair (Graton & Ric, 2017). It would seem consistent that emotion also guides our visual perception towards facilitating the achievement of a specific behavioral goal. Research has mainly investigated this "top-bottom" approach to emotions on visual perception following a general framework perspective, sometimes summarized under the concept of "affective realism", indicating for instance that our affective feelings help us to better perceive the world (Barrett & Bar, 2009). More specifically, Baumann and DeSteno (2010) already showed through 5 experiments that anger increased the likelihood that "neutral" and ambiguous objects were identified as weapons. Following a conception of emotions oriented towards "goals" and actions, it seems however relevant to ask whether other emotions, triggered by other appraisals and with different characteristics, can generate the same type of bias of perception. A natural candidate for this comparison is the emotion of fear. Because of its preparation for "escape" behaviors, it seems consistent that a process of enhanced visual identification of threatening stimuli may be involved. We have already discussed the attentional biases generated by fear, but curiously the effects of fear on motivated perception have never, to our knowledge, been directly compared to those of anger.

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The aim of two studies was therefore first to replicate the effects of motivated perception caused by anger (Study 1) and then to extend the comparison to the emotion of fear (Study 2).

Study 1

The purpose of this first study was first to examine whether the emotion of anger, compared to a neutral control group, could lead to a change in visual perception in the sense of greater acuity to weapon-related stimuli. For this purpose, we used other stimuli, emotional induction and statistical method than Baumann & DeSteno (2010). First, there are several methods of anger induction (see Lobbestael, Arntz, & Wiers, 2008). We chose the "stress interview" method (Dimsdale, Stern, & Dillon, 1988), recognized to activate both a good level of subjective feeling and physiological activation (Lobbestael, Arntz, & Wiers, 2008). This method consists of an interview of approximately 10 minutes during which participants are asked to recall an episode in which they experienced deep-seated anger and to share it with the experimenter in as much detail as possible. Although not hostile, the experimenter shows, through reminders, his perplexity and astonishment at some of the participant's responses (e.g., "I see, but what did you do to find yourself in such a situation?"). Participants then completed a visual puzzle consisting of ambiguous images that could be perceived as weapons or neutral objects (e.g., a grenade or pineapple).

Method

Participants and sample size

Participants had to be between the ages of 18 and 59 and not have any psychiatric pathology or visual impairment. 88 participants (46 males, $M_{age} = 23.6$, $SD = 4.5$) were recruited on a voluntary basis on the site of XXX University. They were randomly assigned to one of the two experimental conditions (anger vs. control). The sample size for this study was determined *a priori* relying on previous work in the area of wishful seeing and attentional biases shown for anger (Baumann & DeSteno, 2010 ; Wilkwocki et al., 2007). In these sets of

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studies, the effect sizes (partial eta squares) ranged from .09 to .25 ($M = .15$) while the average effect size of the original wishful seeing studies can be estimated at $d = .63$ (Balci et al., 2010), which shows a large disparity between studies. Using a reasonably conservative assumption, we calculated our sample for an effect size of $d = .6$. Not having found a power analysis exactly tailored to the generalized mixed model here, we relied on the power analysis with crossed random effects tool provided by Westfall, Kenny and Judd (2014) to provide 80% power, giving a total number of 81 participants. The time available for the study allowed us to recruit 88 participants. Three participants were removed before analysis for not completing the experiment and another as a statistical outlier ($RSS > 4$) bringing the final sample to 84 participants.

Emotion Induction

Participants were run individually. After signing a consent form, they were informed that they would be participating in two consecutive but separate studies that were grouped together for organizational reasons, the first being a "life event inventory" and the second being a vision study. Participants were then welcomed in the experimental cubicle by the experimenter, who specified that the responses collected would remain anonymous and confidential. For the "anger" condition, the experimenter would then sit down in front of the participant and ask her/him to talk about a situation where she/he might have felt a strong emotion of anger (stress interview). During the interview, the experimenter asked the subjects to give as many details as possible: the moment that triggered the anger, the environmental conditions in which this emotion appeared, the feelings they experienced (physiological, psychological changes, etc.), their thoughts, what they wanted to do at that time, what they said to each other, what they did. Throughout the interview, the experimenter adopted a neutral attitude towards the subject while remaining non-empathetic and perplexed by the subject's statements. For the control condition, the experimenter asked the participant to

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describe a typical weekday in his or her life, in detail and in order. In both conditions, the interviews lasted about ten to twelve minutes. Participants were then asked to report on a paper questionnaire the extent to which they were experiencing anger, guilt, joy, irritation, fear, pride, sadness, shame and embarrassment at the very moment (from 0 = not at all to 6 = extremely). The participants were thanked for their participation in this first study. They were then placed about 75cm away from a computer screen to take part in the "second" study, which the experimenter described as "a pre-test of material for a visual perception task".

Visual Puzzles

The material was created by drawing objects using the Adobe Illustrator© software. These visual objects consisted of jigsaw puzzles: a first part of the image corresponding to the "base" of an object, and two other drawings that could complete the original image in two ways. For the experimental stimuli, the way to complete the image could either be in the form of a weapon (e.g., a grenade, see Figure 1) or a neutral object (i.e., not related to the aggression, e.g., a pineapple, see Figure 1). Another set of stimuli was created where both ways of completing the original image resulted in a neutral object (see Figure 1). These control stimuli were designed to prevent a weapon from being completed in the drawing at each presentation. Two pre-tests were carried out to test this material. A first pre-test ($N = 32$) consisted of verifying that the "threatening" objects were well perceived as related to aggression. Only images were kept that had a score of more than 7 for aggression (scale from 0 to 10 "to what extent can the following object be used to aggress/injure others"). A second pre-test ($N = 59$) consisted of testing the material to avoid ceiling and floor effects and to ensure that, on average, for the experimental stimuli, participants chose as many aggression-related image completions as neutral. Pre-test participants were confronted with the visual puzzle and had to choose between the two options. The results showed that participants chose 53% weapon-related responses for these stimuli, the difference being non-significant vs 50%

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($p = .54$). A total of 18 experimental stimuli (i.e., puzzles) were retained as well as 18 neutral stimuli (i.e., no possibility to complete with a weapon).

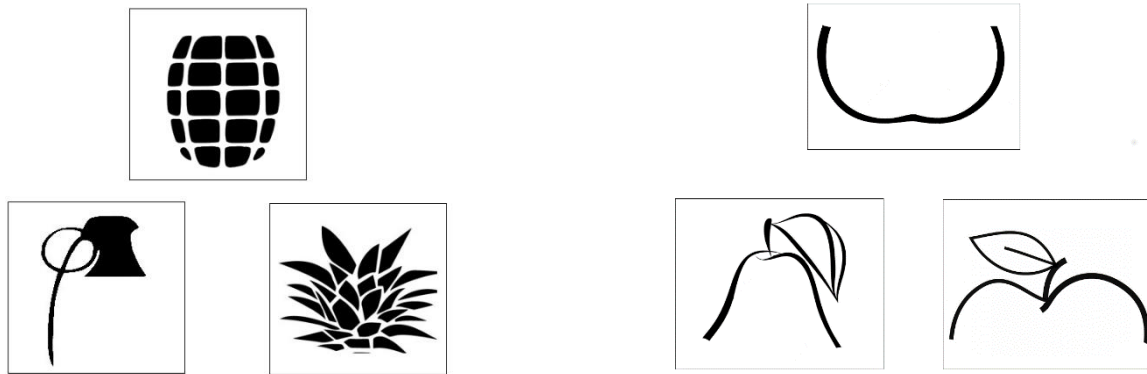


Figure 1: Examples of stimuli presented (left: experimental stimulus, right: control stimulus). Above: the incomplete images, presented 400 ms. Bottom: the two options available to participants.

Procedure

The instructions for the experiment were explained orally to the participants and then recalled on the screen. For recall, the participants had to take part in a “pre-test on visual perception”. They were told that they would quickly see a piece of a picture corresponding to an object appear on the screen. They then had to complete this image on the next screen by choosing one of the two options presented to the left and right of the screen (the position to the right or left of the image was randomized, as was the order in which the stimuli were presented). They were told that only one of the two options was the right one to complete the image seen previously and that their score would be given at the end of the experiment. This incentive was specified so that the participants could focus on the visual aspect of the task. The first image was presented on the screen *via* the OpenSesame® software to the participants. This image was incomplete and did not form any object on its own, so a second image had to be added to complete it (see Figure 1). The image was displayed on the screen

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for 400 ms. This duration was inspired by the ambiguous stimuli presented in the wishful seeing experiments (see Balcetis & Dunning, 2010): long enough to perceive the shape but not long enough to realize that it could be part of several objects. Two choices were then proposed to the subjects to complete this "basic" image. Participants had 3000 ms to respond before moving on to the next screen. Before starting the experiment, the participants carried out 5 training trials with neutral images (i.e., no weapon). Participants' response times were also recorded. At the end of the 36 drawing completions (18 experimental stimuli, 18 neutral stimuli), the participants filled in their age and sex, were thanked and debriefed.

Results

Emotion Induction

An ANOVA (anger vs. control) was conducted on the level of anger and showed that, as expected, participants in the anger condition reported more anger ($M = 3.31$, $SD = 1.76$) than control participants ($M = 0.74$, $SD = 1.27$), $F(1, 82) = 58.97$, $p < .001$, $\eta^2 = .41$. "Anger" participants also reported more anger than all other emotions ($ts > 3.80$, $ps < .001$), except irritation ($p = .142$).

Visual Puzzle

To measure the effect of our experimental condition on the stimuli, we relied on a Generalized Mixed Model (logistic family) to measure whether participants were more likely to detect "weapon" than "non-weapon" puzzle completions. The experimental condition (anger vs. control) was entered as a predictor and fixed effect. Participants and stimuli were used as random effects. Data from the 84 participants responding to the 18 experimental stimuli made a total of 1,438 observations to fit the model.

Mixed model analysis revealed that "Angry" participants were 1.39 more likely than "Control" participants to see weapons in the visual puzzle, but the OR was not significant, $z =$

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1.86, $p = 0.063$, 95% CI [0.982 ; 1.98]. Another model was run using reported anger as a continuous predictor (with participants and stimuli as random factors) and showed that the amount of anger led to a 1.21 increase in weapon recognition in the visual puzzle, $z = 4.82$, $p < 0.001$, 95% CI [1.12 ; 1.31].

Intermediate Discussion

The results of this first experiment showed that, compared to an emotionally "neutral" group, participants with whom the emotion of anger had been experimentally induced seemed to identify more weapon-related objects in an ambiguous visual recognition task, although we only found a clear effect with the amount of reported anger and not with the experimental group, suggesting that the "feeling" dimension of emotion (i.e., the amount of self-reported emotion as assessed through the questionnaire) may be a better predictor here than other components that could have been triggered by the experimental manipulation (e.g., facial expression or physiological responses), although we did not measure those other components. These results are consistent with the hypotheses of "motivated perception" where participants' motivation may have directed their visual perception towards objects directly related to their behavioral goal (i.e., aggression) but not all emotional dimensions seem to be involved at the same level.

Study 2

The objective of this second study was to replicate the results obtained and to compare anger to fear. Since the first study relied on a forced choice measure (the puzzle), we also decided to add a second type of material with blurred stimuli. In order to be able to use the same method of emotional induction for all three emotions as well as for a "neutral" group, we chose to use handwritten autobiographical recalls (see, for example, Strack, Schwarz, & Geschneidinger, 1985). Finally, in addition to the neutral control group, we added a "sadness"

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group in order to have a negative emotional control group not related to aggressive behavior or attentional tendencies towards threatening stimuli.

Method

Participants and sample size

A power analysis was performed by adjusting the calculation based on the effect size observed in Study 1, which was smaller than initially considered. The power calculation indicated a sample size of 276 participants. A total of 293 participants (41 males, $M_{age} = 18.65$, $SD = 1.43$) could be recruited from the University in exchange for course credits. Two participants were excluded for not finishing the study.

Procedure

Participants were run individually and randomly assigned to one of the four experimental conditions (anger, fear, sadness and control). For the emotion induction part, participants had to write down a short essay (10 minutes) about a personal experience in which they had experienced anger, sadness, fear or to describe a typical weekday of their life (control condition). Like in Study 1, Participants were then asked to report the extent to which they were experiencing anger, guilt, joy, irritation, fear, pride, sadness, shame and embarrassment at the very moment (from 0 = not at all to 6 = extremely). After this first part, the participants were set up by the experimenter at a computer to take part in the second part (object recognition). The visual puzzle task was exactly the same as the one described in Study 1. After completing the task, participants were presented with a second task, five ambiguous and blurred stimuli, which could be perceived as objects associated with threat or not (Figure 2)¹. The participants were asked to answer which object was blurred. The object

¹ the means for recognition of a "weapon" object over a "neutral" object for the 5 stimuli were respectively 46%, 21%, 63%, 73%, 36%, suggesting that the stimuli could be perceived either as weapons or as neutral objects.

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was presented for 3000 ms and then the participants had to enter a free response using the keyboard. After this task, the participants were finally debriefed and thanked.



Figure 2: Blurred stimuli that could be perceived as weapons (e.g. from left to right, dynamite, target, axe, ninja star, brass knuckles) or not (candle, buoy, broom, star, ring etc.)

Results

Emotion Induction

ANOVAs followed by planned comparisons were conducted on emotional levels to check the experimental inductions of anger, fear and sadness. Participants in the anger group reported more anger ($M = 3.74$, $SD = 2.35$) than the fear ($M = 2.27$, $SD = 2.93$), sadness ($M = 2.03$, $SD = 2.01$) and control ($M = 0.44$, $SD = 1.11$) groups, $F(1, 287) = 33.11$, $p < .001$, $\eta_p^2 = .26$. Similarly, participants in the fear group reported more fear ($M = 3.25$, $SD = 2.43$) than the anger ($M = 1.51$, $SD = 1.81$), sadness ($M = 1.63$, $SD = 1.83$) and control ($M = 0.52$, $SD = 0.91$) groups, $F(1, 287) = 27.7$, $p < .001$, $\eta_p^2 = .23$. Finally, participants in the "sadness" group reported more sadness ($M = 3.55$, $SD = 1.52$), than the anger ($M = 2.71$, $SD = 2.07$), fear ($M = 2.01$, $SD = 1.79$) and control ($M = 0.96$, $SD = 1.06$) groups, $F(1, 287) = 32.03$, $p < .001$, $\eta_p^2 = .25$. Within each group, the experimentally induced emotion was felt more than the other emotions ($ts > 3.57$, $ps < .01$), except for a trend difference observed, for the fear group, between joy and fear ($p = .055$). These results suggest that the emotional inductions worked well.

Visual Puzzle

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To test our hypotheses, three orthogonal contrast codes were created (see Table 1) to compare first (C1), the emotions of anger (1) and fear (1) taken together vs. the sadness and control groups (-1 each), second (C2) the anger (1) vs. fear (-1) groups and finally in a third residual contrast (C3), the opposition between the sadness (-1) and control (1) groups.

Contrast	Anger	Fear	Sadness	Control
C1	1	1	-1	-1
C2	1	-1	0	0
C3	0	0	1	-1

Table 1: Contrast codes used for Study 2

As in study 1, we used a Generalized Mixed Models (logistic family) to measure whether participants were more likely to see "weapon" than "non-weapon" pictures. The planned comparisons (C1, C2 and C3) were entered as predictors and fixed effects. Participants and stimuli were used as random effects. Data from the 291 participants responding to the 18 experimental stimuli made a total of 5,228 observations to fit the model.

Mixed model analysis for our contrast of interest (C1) showed that "Anger" and "Fear" groups were 1.2 more likely than "Sad" and "Control" participants taken together to see weapons in the visual puzzle, $z = 3.91$, $p < 0.001$, 95% CI [1.095 ; 1.32]. The results of C2 showed that the "Anger" group was 1.08 more likely to detect weapons than the "Fear" group, $z = 2.049$, $p = 0.04$, 95% CI [1.006 ; 1.30], although this effect is modest. No difference was found between the "Sad" and "Control" groups (C3), $z = -.52$, $p = .61$, $OR = 1.03$, 95% CI [.91 ; 1.17].

As in Study 1, another model was run using reported emotions as continuous predictors (with participants and stimuli as random factors). This model showed that the

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amount of anger led to a 1.1 increase in weapon recognition in the visual puzzle, $z = 4.81$, $p < 0.001$, 95% CI [1.056 ; 1.15]. No effect was found for the amount of reported fear, $p = .215$

Blurred stimuli

First, participants' responses were coded by an independent judge in addition to the experimenters: "1" when the image was identified as a threatening object (e.g., dynamite or target), "0" when it was not (e.g., "buoy" or "pencil"). We then used a Generalized Mixed Model with, as fixed factors, the same contrast codes as for the visual puzzle and participants and stimuli as random effects. Data from the 291 participants responding to the 5 experimental stimuli made a total of 1,455 observations to fit the model. Results showed that "Anger" and "Fear" groups (C1) were 1.17 more likely than "Sad" and "Control" participants taken together to see blurred stimuli as threatening objects, $z = 2.10$, $p = .036$, 95% CI [1.011 ; 1.36]. The results of C2 showed no difference between "anger" and "fear", $z = -1.84$, $p = 0.066$. No difference was found between the "Sad" and "Control" groups either, $z = 1.26$, $p = .21$. No effect was found for the reported emotions of fear ($p = .66$) or anger ($p = .24$)

Intermediate Discussion

The results of this second study allowed us to replicate those of the first, and thus to confirm the effects of anger on motivated perception with other stimuli and other induction methods. They also showed that these effects were more marked for anger than for fear. The perceived motivational effect appears to exist for an emotion associated with threat such as fear, but this effect seems to be less significant than when the perception is more directly associated with the behavior (i.e., aggression). This seems to show that the "feeling is for doing" theory (Zeelenberg & Pieters, 2006) might lead to visual perception biases more important than the cognitive biases traditionally studied in the field of emotions towards the source of the emotion (e.g., snakes or threatening faces with fear and anxiety). Finally, our results are more contrasted concerning the impact of self-reported emotions. Through our

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results, this dimension does not seem to be the best predictor of the effects of emotion-driven motivated perception.

General Discussion

Historically, the study of cognition, emotion and perception (especially visual perception) were separate fields. These different processes were perceived as distinct in nature and without overlap. A few years ago, however, research has shown that interactions were strong and that reciprocal influences between affect, cognition and perception were frequent. Interpretations were then formulated in terms of "paternalistic perception" (Firestone, 2013) making a clear link between the perceived world and our perceptual (visual) system in order to guide our actions. These explanations are now being called into question, with possible interpretations in terms of experimental demand and, more broadly, non-perceptual biases (Firestone, 2013). To these theoretical limitations we have added that, in the emotional domain, many earlier studies carried risks of Type I error due to a failure to take into account the possible error provoked by the stimuli, as well as a failure to take into account the specificity of certain affects with regard to the goals provoked. Our results allow us to partially reconcile the mechanisms of "wishful seeing" (Balcetis & Dunning, 2006) and the emotional approach "feeling is for doing" (Zeelenberg & Pieters, 2006) although questions about the theoretical background of these effects remain.

Emotions are indeed intimately and specifically related to characteristic behavioral tendencies (Frijda, 1986, 2006; Roseman et al., 1994; Zeelenberg et al., 2008). The cognitive and perceptive mechanisms through which the passage from *feeling* to *doing* takes place remains little known, although research regarding the impact of emotions on motivated perception and visual biases is not new (see Cole & Balcetis, 2021). Anger, for example, has been previously identified as potentially generating perceptual biases toward ambiguous or neutral stimuli perceived as threatening (Baumann & DeSteno, 2010). However, few other

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studies have attempted to replicate these effects and the failure to include mixed models in the analyses also made it difficult to interpret beyond the stimuli used in the experiments. The two studies presented here have replicated these effects of motivated perception and extended them to another emotion, fear. These results reinforce the existing literature showing attentional biases toward threat for people experiencing fear (e.g., Fox, 2002; Mogg & Bradley, 1999) adding a "perceptual" bias to attentional biases. They show that these effects are more ambiguous when feelings are used as predictors, suggesting a potential differentiation in the impact of different emotional dimensions in perceptual biases. It is also conceivable that, in an analogous way to anger or fear with weapon-related stimuli, other "wishful seeing" processes would be involved for other emotions and could be implemented: towards stimuli related to reparation for guilt (e.g, to stimuli related to reparation for guilt like objects in the form of a gift or a bouquet of flowers as an apology), cleanliness for disgust (sponge, brush), escape for fear (hiding place, cave) etc. From this investigation will result a better understanding of the intermediate stages between emotion and action.

Another specific feature of our research is the "incidental" nature of the link between emotion and perception: here, the emotions induced were separate from the task at hand. In other words, the reported expressions of anger or fear in the autobiographical recalls were not necessarily linked to experiences of violence or confrontation with armed or threatening people. This tends to show that the effects observed are attributable more to general goals associated with emotions than to a direct "paternalistic" effect provoked by the testimony. In this sense, old theories such as "affect as information" (Schwarz & Clore, 1983, 1996) still seem to us to be relevant in terms of interpretation: in this paradigm, which stems from the psychology of emotions, emotion plays the role of informant about the environment. In our studies, incidentally triggered fear or anger could therefore provide information about an unsafe or threatening environment, and thus direct attention and perception towards

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associated stimuli (i.e., weapons).

There are several limitations to our studies. First, our results seem to indicate modest effect sizes, although relatively homogeneous across studies. Thus, it should be kept in mind that emotions predict only a small part of the variance in stimulus detection in our studies. Another limitation concerns the very concept of visual perception. It is arguable that the proposed stimuli are not exclusively about visual perception but are, for example, a simple effect of cognitions influenced by the emotional state. There is also a possibility that confrontation with the semantics of emotions during the experimental induction phases may have been such as to increase statements of feeling, over and above a genuine affect effect. We believe however that the way the task was presented (vision tasks with only one possible response and two different kinds of stimuli), based on previous work on wishful seeing, the fact of having both compared groups and reported feelings as well as our results attest that specific perceptual mechanisms were activated by emotional states. Further and more precise work in the field of vision could however be carried out in the future to refine the concept of visual perception. Other studies could also focus on the physiological explanations of these perceptual distortions.

Ultimately, our results are consistent with the existing literature on the link between emotion, cognition and perception (Clore, Proffitt, & Zadra, 2021) and show that the interactions between these concepts, and the specificity of emotions in the link with behavior, merit further investigation in future studies. On the other hand, they do not shed light on potential alternative non-perceptual biases that could explain certain results, nor do they prove that these effects are indeed due to the theory of paternalistic vision. In this sense, we are tempted to adopt an intermediate position consistent with Carvalho's (2022) proposals: emotions can distort perception in a direction congruent with the goals generally associated with a specific emotion (i.e., aggression with anger), but the precise interpretation asked of

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participants (i.e., object recognition in our case) can also be influenced by other non-perceptual factors: experimental demand, semantic priming or internal affective state acting as information. Further avenues of research should also include thinking about the utility and impact of motivated perception processes on both behavior and other processes, such as self-regulation (Cole & Balcetis, 2021). It would be interesting to see if these biases mediate subsequent behaviors/mechanisms, although due to the small effect sizes and the different nature of the variables, we argue that mediations would probably be difficult to show.

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