Attentional Biases Towards Body Expressions of Pain in Men and Women

Edmund Keogh [a,b,*], Nina Attridge [c], Joseph Walsh [d], Jessica Bartlett [b], Rachel Francis [a], Janet H. Bultitude [a,b] and Christopher Eccleston [b,e]

[a] Department of Psychology, University of Bath, UK

[b] Bath Centre for Pain Research, University of Bath, UK

[c] School of Science, Loughborough University, UK

[d] School of Society, Enterprise & Environment, Bath Spa University, UK

[e] Department of Clinical and Health Psychology, Ghent University, Belgium

* Correspondence: Edmund Keogh, Department of Psychology & Bath Centre for Pain Research, University of Bath, Claverton Down, Bath, BA2 7AY, United Kingdom, Tel: +44(0)1225 383671; Fax: +44(0)1225 386752; Email: e.m.keogh@bath.ac.uk

Disclosures

The authors have no known conflicts of interest to declare.

Abstract (190/200)

This study investigated whether there are gender differences in attention to bodily expressions of pain and core emotions. Three experiments are reported using the attentional dot probe task. Images of men and women displaying bodily expressions, including pain, were presented. The task was used to determine whether participants' attention was drawn towards or away from target expressions. Inconsistent evidence was found for an attentional bias towards body expressions, including pain. While these biases were affected by gender, patterns varied across the Experiments. Experiment 1, which had a presentation duration of 500 ms, found a relative bias towards the location of male body expressions compared to female expressions. Experiments 2 and 3 varied stimulus exposure times by including both shorter and longer duration conditions (e.g., 100 vs. 500 vs. 1250 ms). In these experiments, a bias towards pain was confirmed. Gender differences were also found, especially in the longer presentation conditions. Expressive body postures captured the attention of women for longer compared to men. These results are discussed in light of their implications for why there are gender differences in attention to pain, and what impact this has on pain behaviour.

Keywords: gender; pain; nonverbal communication; body; attention

Perspective (47/50)

We show that men and women might differ in how they direct their attention towards bodily expressions, including pain. These results have relevance to understanding how carers might attend to the pain of others, as well as highlighting the wider role that social-contextual factors have in pain.

Highlights

- Three experiments explored how observers view bodily expressions of pain
- We found that men and women might differ in how such expressions are attended to
- However, the precise pattern varied across the experiments, limiting conclusions
- We need to better understand the interpersonal gender context of pain

Introduction (589/600)

Psychosocial approaches often focus on cognitive and emotional factors to help understand the variation in men and women's pain [19, 20]. For example, anxiety has been found to be more strongly related to pain in men, whereas depression has a stronger relationship with pain in women [17, 36, 44]. In experimental studies, focusing attention on pain sensations has also been shown to increase the pain thresholds of men more than women [34, 35], whereas women report more negative pain thoughts, greater negative appraisals of body signals, and higher cognitive intrusion from pain [33, 49]. Additionally, men and women might also be differentially affected by the social context in which pain occurs. Pain experiences can vary according to whether an individual is accompanied by a same sex observer or not [7, 18]. Men and women's pain can also be judged in different ways, which could lead to biases in healthcare provision [27, 54, 55, 65].

One approach that allows for the combined investigation of emotional, cognitive and social processes is to explore how pain is communicated [5, 25, 39, 61]. Nonverbal communication involves both encoding and decoding processes, and requires individuals caring for those in pain to be able to effectively detect and understand the cues that are presented. Women are thought to be generally better at decoding emotional expressions [23, 24]. However, there is less consistent evidence for gender differences in the recognition of pain [28, 30]. One possibility is that there are no differences in how pain is decoded. However, this conclusion would seem premature since most studies focus on facial expressions whereas other channels of communication exist e.g., body expressions [15, 61, 62]. Also, most studies use recognition paradigms and so do not consider the range of perceptual and/or attentional processes involved. For example, whilst men and women may be similar in their ability to recognise pain once detected, there may be differences in the initial orientation of attention towards such expressions. Both those in pain, and those who care for individuals in pain, exhibit attentional biases towards pain expressions [46, 47, 58]. It is possible, therefore, that gender differences exist in the way pain expressions are attended to. Whilst there is related evidence for gender differences in attentional biases towards emotional stimuli [10, 51, 53, 59], few studies have directly explored this for pain expressions. In one of the few to have done so, a study by Keogh et al. [31] suggested that both men and women attended away from female facial pain expressions. However, this effect is limited to one study, and one channel of pain communication i.e., facial expressions.

This study considered gender differences in attentional biases towards body expressions of pain. Across three inter-related experiments, presentation duration was varied to establish whether biases are stronger at earlier or later stages of attention, whereas varying the valance of expressions allows for a test of the specificity of biases found. Given there are a limited number of studies that explore gender-related attentional biases predictions were based on the general observation that women experience more pain than men, and that pain is attentional grabbing. It was predicted that (1) men and women would exhibit attentional biases towards the location of pain expressions, and (2) this would be most apparent in women. Since there may be a stronger same gender face recognition effect in women [1, 26, 38], we predicted women would orient attention more towards female than male expressions of pain. Although fear and sadness expressions were included, no predictions were made about expression pair type.

Experiment 1

Methods

Design

A mixed-groups design was used. The within-groups factors were expression pair type (pain/neutral vs. fear/neutral vs. sadness/neutral), gender of actor (male vs. female), and the between-groups factor was participant gender (male vs. female). The dependent variable was an attentional bias score for each participant.

Participants

Forty adult participants (20 female, 20 male), aged 19 to 29 (M = 20.95, SD = 1.60), were recruited from the University of Bath student population using a convenience sampling approach. The only requirement was that participants were adults, and had not taken pain medication on the day of testing. A target sample size of 20 participants per group was set, and was based on what was possible given funding and time limitations. It was also guided by what has been used in a previous study on gender differences in attentional biases to pain expressions using a dot probe task [31]. We acknowledge this approach may not be considered ideal, but it does reflect the real world constraints that are common in conducting research [42].

Body expression stimuli

Images were taken from the Bath Emotion and Pain Posture Stimulus Set (BEPPS) [61], which comprise whole body figures of 8 male and 8 female actors displaying a range of posed affective expressions (pain, anger, disgust, surprise, fear, happiness, and sadness) as well as a neutral posture. The face is obscured in each image so that the affective information is contained within postural rather than facial cues. In the development and validation study, the postural stimuli were correctly recognised as depicting their target expression, and with a high degree of accuracy [61].

For the current study we collated the 64 unique photographs (325 × 253 pixels) that depicted pain, fear, sadness and neutral expressions. To ensure that the pain and emotional images were similar in terms of their depicted intensity, intensity ratings from previous validation work (comprising 11 adult raters, of which seven were female and four male, aged between 21 and 67 years; M age = 34.91, SD =15.20) were inspected. We removed actors who were rated least equally across the expressions (i.e., male actors 1, 3 and 4; female actors

2, 5 and 8), with analysis indicating no differences in judged expression intensity ratings across the three expressions groups, nor any gender differences. Therefore, for the main experiment 40 unique images of body expression images were used, comprising 5 female and 5 male actors, all of whom displayed each of the four core expressions 10 actors x 4 expressions. Next, 30 unique image pairs were created. The image pairs contained one neutral and one target expression (fear/neutral, sadness/neutral, pain/neutral), both of which were depicted by the same actor i.e., 3 image pairs x 10 actors.

Dot probe task

An attentional dot probe task was used in the current study. This is an objective measure of attentional biases towards threat, which has been used extensively within the field of anxiety and has been successfully adapted to examine pain-related vigilance [14]. The version of the dot probe task used here was based on that described in previous studies [4, 31, 32], and controlled using E-Prime Professional 2.0.

Each trial started with the presentation of a white fixation cross in the centre of a black background on the computer screen for 500 ms. Next, a pair of images were presented, one either side of the fixation point, for 500 ms, with the inner edges separated by 4 cm of neutral space. The images were removed from the screen, and in the location of one of them, a dot probe was displayed. Participants were instructed to indicate where the dot had appeared, by pressing the ‘z’ key to indicate left or the ‘m’ key to indicate right. The dot remained on the screen for either 2000 ms or until a response was made, upon which a blank screen appeared for 500ms. Participants could respond from when the dot first appeared until the end of the 500ms blank screen, when the next trial began. Response accuracy and the response times (RT) were recorded.

For each of the 10 actors there were three expression pairings. Each pair was presented four times to counterbalance the side of the screen the expression and dot probe appeared. This resulted in 120 unique trials, which were each presented twice to ensure there were 20 trials per cell i.e., there were 240 trials in total (2 [actor gender] x 3 [expression pair] x 2 [target expression location] x 2 [dot probe location]). Trials were selected in a random order for presentation.

Procedure

The experiments reported here were approved by the University of Bath Psychology Ethics Committee (REF: 14-210). Following the provision of informed consent, participants completed a short demographic questionnaire and the dot probe task. In addition, a short battery of questionnaire measures was administered: Anxiety Sensitivity Index-3 [57], Pain Catastrophizing Scale [56], Cognitive Intrusion from Pain Scale [2], and the Short Form Depression Anxiety Stress Scales [43]. Since attentional biases are often related to anxiety and fear-related constructs, these measures were included to check whether any gender differences would be found, and help explain any male-female differences in attention. These measures were chosen as they generally reflect the core negative components associated with pain [8, 50]. The experiment took around 30 minutes to complete. At the end of the experiment participants were provided with details of the study, and given course credits.

Statistical methods

Mixed-groups Analysis of Variance was conducted on the attentional bias indexes. Significant interactions were further explored using Bonferroni corrected follow-up *t*-tests. In addition to determine whether any of the bias indexes were significantly different from 0, one-sample *t*-tests were also conducted.

Results

Data screening

The response time (RT) data were screened by removing all inaccurate responses, as well as trials where responses were shorter than 200ms i.e., anticipatory errors [32]. The percentage of responses removed was less than 3%, which is within an acceptable 5% limit. However, investigation of standardized scores indicated that one individual was an outlier from the sample (9% errors), and so was excluded from the main analysis. The final sample comprised 20 males and 19 females, aged between 19 and 29 (M = 21.00, SD = 1.62). Three women reported experiencing pain at the time of the study. No significant gender differences were found for age (males M = 21.35, SD = 1.93, females M = 20.53, SD = 1.12; $t(37)$ = 1.62, p =.114, Cohen's d = 0.52), pain catastrophizing (males M = 14.63, SD = 8.74, females M = 15.58, SD = 11.45; $t(36)$ = .29, p = .776, Cohen's d = 0.09), anxiety sensitivity (males M = 15.06, SD = 7.51, females M = 15.68, SD = 9.85; $t(35)$ = .22, p = .829, Cohen's d = 0.07), cognitive intrusion (males M = 19.05, SD = 12.89, females M = 23.16, SD = 15.90; $t(36)$ = .87, p = .388, Cohen's d = .28) or negative mood (males M = 17.15, SD = 12.04, females M = 13.84, SD = 11.68; $t(37)$ = .87, p = .390, Cohen's d = .28).

Table 1 here

Response times

Attentional bias index scores for each image pair type were calculated from the RT data [32] by taking the average response to congruent trials (target expression and dot probe in the same location) away from trials where the dot appears in an incongruent location. The mean was 2.45, with a SD of 11.18 (range: -20.20 to 34.90). A positive score is viewed as a relative bias towards the location of the target expression, and a negative score indicates a relative avoidance. Means and standard deviations of the bias indexes can be viewed in Table 1. This table also presents a series of one-sample t-tests on the bias indexes, with zero as the comparison. The only significant effect found was for the bias index for male expressions of pain, which was a positive value and so suggests greater attentional orientation towards pain relative to neutral expressions when depicted by a man.

A mixed-groups ANOVA was conducted on these biases indexes, with gender of participant (male vs. female) as the between-groups factor, and gender of actor (male vs. female) and bias index type (pain vs. fear vs. sadness) as within-groups factors. A significant main effect of gender of the actor was found ($F(1, 37) = 4.27$, $p = .046$; $\eta_p^2 = .10$). Means indicate a greater vigilance towards body expressions made by male actors verses their neutral postures ($M = 5.95$, $SD = 15.01$), relative to body expressions made by female actors verses their neutral postures ($M = -1.05$, $SD = 16.05$). To see whether these were different from zero, two one-sample t-tests were conducted. This was significant for the average male actor bias index ($t\,(38) = 2.48$, $p = .018$, Cohen's $d = .40$), but not the female actor index ($t\,(38) = .41$, $p = .685$, Cohen's $d = .07$). No other significant effects were found.

Discussion

Although an attentional bias towards body expressions was found, it depended on gender. Also, rather than finding a gender difference specific to pain, the main analysis found that both men and women generally oriented attention towards the location of the body expressions of males relative to neutral controls. One possible reason for this could be that observer gender differences may only occur when stimulus exposure times are of a relatively longer duration i.e., to allow for more detailed processing Work on attentional biases for threatening words suggests that gender differences may be more likely when stimulus images are presented for relatively longer durations

The rationale for the second experiment was therefore to extend Experiment 1 and examine whether gender differences in attentional biases to pain depend on early or late stages of attention. Two additional conditions were included, where the stimulus exposure duration was varied: we added a very brief exposure condition (i.e., 100 ms), and a much longer exposure condition (i.e., 1250 ms). These exposure times were chosen based on their common usage in previous dot probe tasks, including those that consider pain [3, 14]. Based on previous emotion studies [26, 38, 52] we predicted females would show a greater same-gender attentional bias when exposure times were of longer durations compared to when exposure times were of shorter duration. Since no effect of type of expression bias was found in Experiment 1, no predictions were made with respect to bias index type.

Experiment 2

Materials and Methods

Design and task details

A similar mixed-groups design was employed as used in Experiment 1. The main difference was the inclusion of an additional within-groups factor: expression exposure duration (100 ms vs. 500 ms vs. 1250 ms). The task protocol was similar to that described in Experiment 1. The main difference was there were three different versions of the task, which reflected the three different initial presentation exposure times for the body expression pairs (i.e., 100 ms, 500 ms or 1250 ms). There were three blocks of 240 trials (exposure times varied between blocks, not within), with the order of blocks counterbalanced between participants. Experiment 2 consisted of 720 trials in total, with a break between each block.

Participants and procedure

Forty-seven participants (25 female, 22 male), aged 18 to 77 (M = 25.91, SD = 12.78) were recruited from the University of Bath. All provided informed consent, completed similar questionnaire measures as in Experiment 1, and the dot probe task. The experiment took around 45 minutes to complete. Participants were debriefed, and given either £4 or course credits.

Results

Data screening

Data were screened in the same way to Experiment 1. Incorrect trials and trials with RTs shorter than 200ms were removed. The overall percentage of errors was 2.5%. Inspection of standardized scores indicated that one participant had an outlying 19% error rate, and so was removed. The final sample comprised 21 men and 25 women, aged between 18 and 58 (M = 24.80, SD = 10.38). Three men reported being in pain at the time they conducted the study. Two participants (1 male, 1 female) did not complete all items on the DASS. Gender differences were found for age (males M = 28.86, SD = 13.84; females M = 21.40, SD = 4.01; $t(44)$ = 2.57, p = .014, Cohen's d =.76) and pain catastrophizing (males M = 12.19, SD = 7.97; females M = 19.76, SD = 8.42; $t(44)$ = 3.11, p = .003, Cohen's d =.92), but not anxiety sensitivity (males M = 14.38, SD = 9.08; females M = 16.60, SD = 7.46; $t(44)$ = .91, p = .368, Cohen's d =.27) or negative mood (males M = 11.55, SD = 8.09; females M = 15.00, SD = 8.46; $t(42)$ = 1.37, p = .177, Cohen's d =.42). Results involving observer gender need to be cautiously interpreted in light of these group differences.

Table 2 here

Response times

A similar set of bias indexes were created as described for Experiment 1 (see Table 2). The mean bias index was 7.42, with a SD of 8.37 (range: -10.42 to 35.16). Table 2 presents the one-sample t-tests on each bias index, with zero as the comparison. All bias indexes were significantly different from zero at 100 ms, whereas only the pain indexes were significant for 500 ms. At 1250 ms, the only significant difference was for the male expression pain index.

A similar mixed-groups ANOVA to that reported in Experiment 1 was conducted on these indexes, with presentation expression exposure duration (100 ms vs. 500 ms vs. 1250 ms) included as an additional within-groups factor. This revealed a significant main effect of exposure duration on the bias index (100 ms M = 11.46, SD = 10.64; 500 ms M = 6.86, SD = 12.34; 1250 ms M = 3.93, SD = 16.68; $F(2, 88) = 4.69$, $p = .012$; $\eta_p^2 = .10$). Follow up t-tests, with a Bonferroni correction applied (.05/3 = .0167), indicated that compared to the 1250 ms exposure condition, a significant difference in the overall bias index was found in the 100 ms condition ($t(45) = 2.70$, $p = .010$, Cohen's $d = .40$), but not in the 500 ms condition ($t(45) = 1.05$, $p = .299$, Cohen's $d = .16$). No difference was found between 100 and 500 ms either ($t(45) = 1.85$, $p = .071$, Cohen's $d = .27$).

A main effect of expression type on the bias index was also found ($F(2, 88) = 4.63$, $p = .012$; $\eta_p^2 = .10$). Post-hoc t-tests (p set at 0.167) revealed a greater attentional bias towards the location of pain expressions (M = 11.62, SD = 10.36) when compared to sadness (M = 4.48, SD = 14.79; $t(45) = 2.97$, $p = .005$, Cohen's $d = .44$) but not fear (M = 6.15, SD = 13.10; $t(45) = 2.40$, $p = .021$, Cohen's $d = .35$). No significant difference was found between the fear and sadness indexes ($t(45) = .60$, $p = .550$, Cohen's $d = .09$).

Finally, a significant interaction between gender of participant and exposure duration was found ($F(2, 88) = 3.98$, $p = .022$; $\eta_p^2 = .08$; see Figure 1). This interaction effect was still significant when controlling for pain catastrophizing, as a covariate. To investigate this further, separate analyses were conducted on male and female participants. The main effect of exposure duration was found to be significant in men ($F(2, 40) = 5.85$, $p = .006$; $\eta_p^2 = .23$), but not in women ($F(2, 48) = 1.77$, $p = .181$; $\eta_p^2 = .07$). Post-hoc t-tests conducted amongst men (correction set at .0167) indicated that the bias index was significantly smaller in the 1250 ms condition compared to the 100 ms condition ($t(20) = 3.24$, $p = .004$, Cohen's d = .71). No difference was found between the 1250 ms and 500 ms conditions ($t(20) = 2.29$, p = .033, Cohen's d = .50), or between the 100 and 500 ms conditions ($t(20) = .76$, $p = .458$, Cohen's $d = .17$). In addition, separate one-sample t-tests (p set at .0167) confirmed that for men, the bias index was significantly different from zero at 100 ms ($t(20) = 4.61$, $p < .001$, Cohen's $d = 1.01$) and 500 ms ($t(20) = 2.77$, $p = .012$, Cohen's $d = .60$) but not at 1250 ms ($t(20) = .746$, $p = .464$, Cohen's $d = .16$). This indicates that a general bias towards body expressions occurred in both men and women early on in attention, but while this attentional bias was maintained in women in later phases of attention, it decreased in men.

Figure 1 here

Discussion

Experiment 2 suggests that body expressions of pain selectively capture attention, although the general vigilance for male body expression effect in Experiment 1was not replicated. A general participant gender difference was instead found -- women maintained their attention on body expressions for longer durations compared to men. This suggests that gender differences in attentional capture from non-verbal expressions could depend on both the channel of communication and stage of visual processing.

In this experiment, and the attentional bias literature generally, a distinction has been made between biases due to early attentional engagement, and those due to a slower disengaging of attention from a stimulus[9, 31, 37]. Although it is possible that the gender differences found in Experiment 2 during later phases are due to attentional disengagement processes, it was not possible to directly explore this. This is because Experiment 2 did not include neutral-neutral image pair trials, which are usually required to differentiate between vigilance and disengagement processes [9, 31, 37]. Attentional vigilance (capture) can be explored by creating a vigilance/avoidance index by taking the average response to neutral-

neutral trials away from trials where the dot appears in the same location as the target expression.

Given the potential role of stage of processing, the goal of Experiment 3 was to refine the design to enable the differentiation between vigilance and disengagement processes. This also allows for a more direct comparison with the Keogh et al. [31] study, which focused on gender differences in attentional biases towards facial expressions of pain, and also included neutral-neutral image pairs. The consequence of including additional neutral image pairs was also to adjust the design to ensure a fully balanced exposure to all expressions types – this was to prevent habituation to neutral images due to greater exposure.

Experiment 3

Materials and Methods

Design and task details

A similar mixed-groups design was employed as in the previous experiments. Since the goal was to explore vigilance and disengagement, the task was refined to include a fully balanced set of image pair combinations, including the important neutral-neutral image pairs. Since the number of trials was potentially very high, we reduced a number of the levels within the task to ensure it remained under 1 hour in duration. Specifically, we reduced the expression exposure duration to the two extreme levels (i.e., 150 ms vs. 1250 ms) and limited the expression type to pain, fear and neutral expressions (i.e., removing sad expressions). Experiment 3 used 150 ms as that was the same exposure duration used by Keogh et al. [3132], and so allows for a comparison of findings. This resulted in six different image pair presentation conditions: fear/neutral, pain/neutral, neutral/neutral, fear/pain, fear/fear, and pain/pain. This combination ensured that each expression image type was presented an equal number of times. Of these six expression pair combinations, only fear/neutral, pain/neutral, and neutral/neutral expression pairs were required for analyses. The other image pairs were considered filler items, but necessary to ensure each expression appeared a similar number of times. Experiment 3, therefore, comprised of a total of 960 trials, broken down into four blocks of 240 trials, with a rest break between each block. The other design change was that the image pair duration was fully randomized within each block of trials. The reason for this change was simply because to avoid a situation where two blocks of the same presentation duration were repeated for some participants.

Participants and procedure

Fifty participants (25 female, 25 male), aged 18 to 29 (*M* = 20.74, *SD* = 1.63) were recruited from the University of Bath. All provided informed consent, completed the Cognitive Intrusion from Pain Scale [2], the Fear of Pain Questionnaire [45], and then the dot probe task. Although these measures are slightly different from the previous two experiments, they still conceptually relevant and reflect core constructs thought to be relevant to pain [8, 50]. The experiment took approximately 45-60 minutes to complete. At the end of the experiment participants were debriefed as to the purpose of the study.

Results

Data screening

The data were screened in a similar way to before (incorrect trials, and trials with RTs shorter than 200 ms were removed). The overall percentage of errors was 3.8%. Based on standardized scores, one male participant was removed as their overall error rate fell well outside the acceptable group range (19% error rate). The final sample comprised of 24 males and 25 females, aged between 18 and 29 (*M* = 20.73, *SD* = 1.66). No participant reported any current pain. No gender differences were found for age (males *M* = 20.75, *SD* = 1.11; females *M* = 20.72, *SD* = 2.07; $t(47) = .06$, $p = .950$, Cohen's $d = .02$), fear of pain (males *M* = 87.04, *SD* = 13.41; females = 80.76, *SD* = 18.39; $t(47) = 1.36$, $p = .180$, Cohen's $d = .39$) or cognitive intrusion (males M = 25.88, SD = 11.09; females M = 24.60, SD = 12.66; t(47) = .37, p = .710, Cohen's d = .11).

Response times

Attentional bias analysis: Attentional bias indexes were calculated as described for Experiments 1 and 2 (see Table 3). The M was 2.06, with a SD of 13.53 (range: -36.31 to 29.80). As can be seen in Table 3, one-sample t-tests, split by gender, did not find that any of the bias indexes were significantly different from zero.

Tables 3-5 here

A mixed-groups ANOVA was conducted on these indexes, with gender of participant as the between-groups factor (male vs. female), and gender of actor (male vs. female), expression bias type (pain vs. fear) and expression exposure duration (150 ms vs. 1250 ms) as within-groups factors. A significant interaction was found between gender of participant and expression bias type (F (1, 47) = 5.93, p = .019; η_p^2 = .11). Post-hoc t-tests, with Bonferroni correction applied (.05/4), found no significant differences. One-sample t-tests, split by gender, were also non-significant. However, as is apparent from Figure 2, the interaction can be explained by a crossover effect. Specifically, that, for men, there was a greater bias towards pain expressions relative to fear (pain M = 7.61, SD = 18.13; fear M = -2.06, SD = 15.09; t(47) = 1.97, p = .061, Cohen's d = .40). For women, the opposite pattern was found, with a greater bias towards fear relative to pain (pain M = -2.57, SD = 20.25; fear M = 5.32, SD = 20.24; t(47) = 1.51, p = .164, Cohen's d = .30).

Figure 2 here

Congruency index (vigilance): The reason for including the neutral-neutral expression pair trials was to enable a more precise exploration of vigilance and disengagement effects [4, 9, 37]. Vigilance was calculated by taking the average response to neutral-neutral trials away from those where the dot appears in the same location as the target expression. This was done for each level of the study i.e., expression type (pair vs. fear), gender of actor (male vs. female), and exposure duration (early vs. late). If responses are faster for congruent trials relative to the neutral-neutral trials at the earlier exposure duration level, a negative congruency index would be found, which is thought to reflect greater attentional vigilance. A positive value congruency index reflects avoidance (i.e., relative slowing). Means are presented in Table 4, and show a significant one–sample *t*-test for the male pain index at the early exposure phase.

An ANOVA was conducted on these congruence indexes, across the two exposure duration phases (early and late). Significant main effects were found for type of expression bias (fear M = 1.16, SD = 11.94; pain M = -3.88, SD = 18.97; $F(1, 47)$= 4.17, p = .047; η_p^2 = .08), and for gender of actor (female M = 2.70, SD = 16.71; male M = -5.42, SD = 18.71; $F(1, 47)$= 5.68, p = .021; η_p^2 = .11). No effect of time was found. Since early vigilance is expected to be most apparent during the shorter presentation durations [5], exploratory analysis was repeated on just the 150 ms indexes. No significant effects were found. This suggests that whilst greater vigilance may indeed have been found for pain (vs. fear) and for male (vs. female) expressions, this is not limited to the early phase of attentional processing.

Incongruency index (disengagement): As well as vigilance, the inclusion of neutral-neutral trials allows for a measure of disengagement. This is reflected in indexes where the average response to neutral-neutral trials are taken away from responses to incongruent trials, and is best reflected during longer presentation durations. A positive valued incongruence index reflects a lower readiness to disengage, whereas a negative value reflects a shorter time to disengage from target expressions. Means are presented in Table 5, which also shows that none of the one-sample *t*-tests were significant.

An ANOVA on the incongruence indexes was conducted across both exposure duration phases (early vs. late). No significant effects were found. However, some have questioned the inclusion of the early presentation trials in the analysis of disengagement effects, as conceptually time to engage is required before disengagement occurs [4]. Therefore, the analysis was repeated on just the 1250 ms trials. A significant interaction was found between gender of participant and gender of actor in the late phase trials ($F(1, 47) = 6.13$, p = .017; $\eta_p^2 = .12$; see Figure 3). Follow-up, corrected post-hoc *t*-tests failed to find significant differences (p = .0125). However, Figure 3 suggests that when viewing female body expressions, women were slower to disengage, relative to men who seem to disengaged more effectively (male participant M = -7.91, SD = 28.82; female participant M = 9.71, SD = 17.59; $t(47) = 2.60$, p = .013, Cohen's d = .74). No such effect seemed to be found when viewing male expressions (male participant M = -0.00, SD = 20.15; female participant M = -1.45, SD = 18.88; $t(47)$ = .26, p = .797, Cohen's d = .07). One-sample *t*-tests confirmed a significant difference amongst women for the late phase female bias index (M = 9.71, SD = 17.59; $t(24)$ = 2.76, p = .011, Cohen's d =.55), but no other index.

Figure 3 here

Discussion

Refining the task to allow a more precise exploration of attentional biases revealed gender differences. The main finding was that an attentional bias to body expressions of pain depended on the gender of the observer. Men possessed a greater bias to pain-related body expressions, whereas for women this bias was for fear-related expressions. This contrasts with the results reported in Experiment 2, which found a relative bias towards both pain and fear, compared to sadness, and in both men and women.

The second finding was that when looking at differences between early vigilance and later disengagement, women seemed take longer to disengage attention from expressive female body postures. However, this was only found on the later presentation trials, and so caution is required with interpretation. Furthermore, same-gender biases were not found in the two previous Experiments. Experiment 1 found a general, bias toward male expressions, whereas Experiment 2 found that women were more likely to maintain their attention on expressive body postures at later stages of attention. One possible interpretation from Experiments 2 and 3 is that women maintain their attention on expressive body postures, and that this may be due to attention fixedness rather than an early vigilance effect.

General Discussion (1471/1500)

Across three experiments we found somewhat inconsistent evidence for an attentional bias towards body expressions of pain in men and women. Biases were relatively few in number, although when they were found, they were affected by gender-related factors. Careful interpretation is, therefore, required.

Starting with the actor gender effects, Experiments 1 and 2 found a general bias towards expressive body postures, at relatively shorter exposure times (i.e., 500 ms or less). This effect was limited to male actors in Experiment 1, but found for both male and female actors in Experiment 2. This is interesting in light of results reported by Keogh et al. [32] who explored attentional biases to facial expressions of pain and found a relative avoidance of female expressions. Experiment 3 also found evidence for attentional capture when expressions were displayed by both men and women, but only when early vigilance and later disengagement processes were separated. Here, and in contrast to the first two experiments, female body expressions seemed to capture the attention of women, as suggested by a tendency to be slower to disengage from such expressions.

One explanation for the inconsistent effect of actor gender across the experiments could simply be because such effects are unreliable. However, differential detection of male and female expressions have been reported elsewhere, using different tasks [63]. For example, whilst facial expressions may be more easily detected in women, an exception exists for anger, which some have found to be more readily detected in men [11, 21]. Perceptual similarities have been found between pain and anger postures [62], and this may also affect attentional biases, resulting in consistencies. Situational conditions may also led to different patterns. For example, women may be more likely to express emotions in some social situations [24, 30, 41, 60], which may in turn capture observers attention. However, it could also be argued that male expressions are more likely to capture attention because men are thought to be less expressive, and so when expressions do occur, this captures attention. Such explanations are speculative of course, and do not clearly explain why different patterns were found across essentially similar tasks. Therefore, the only definite conclusion that can be made at present is that the effect of actor gender on attentional biases to body expressions, including pain, is inconsistent.

In terms of observer gender differences, effects were found in both Experiment 2 and 3, both of which included trials where exposure duration was relatively long (i.e., 1250 ms). Experiment 2 found that women exhibited an attentional bias towards body expressions irrespective of exposure duration, whereas for men this bias was limited to conditions where image exposure was relatively brief. Experiment 3 also found observer gender differences in the longer image exposure trials. Women seemed to display a lower propensity to disengage from female body expressions, compared to men, who seemed to disengage more readily. Both experiments suggest that if observer gender differences do occur, it is more likely at later stages of attention. This would be consistent with at least one other study, which used words rather than images in a dot probe task, and found gender differences when stimuli were presented for longer durations [52]. The results of the current and previous studies could tentatively suggest that gender of actor biases occur at earlier phases of attention, whereas gender of observer effects occur at later phases. Future research should examine this possibility further, and investigate whether gender-related attentional biases are more likely to be due to a bias in the disengagement of attention from body expressions. Since there are also interesting debates on how best to measure disengagement effects [12, 22], different approaches could also be considered in future research.

An additional aim of the current study was to consider whether biases towards pain are similar to negative emotions. In Experiment 1, there was a suggestion that a bias exists for male expressions of pain, although no overall difference was found across indexes. In Experiment 2, pain expressions were associated with an overall stronger attentional bias towards their location, compared to fear and sadness. Experiment 3 also found evidence for a pain-related bias, especially at early phases of attention. However, there also seemed to be observer gender-specific effects, in that men displayed a greater bias towards pain expressions, whereas for women, this bias was found for fear-related expressions. Although the precise pattern is not consistent across the three experiments, they generally suggest that in some situations pain might be differentially processed from other expressions. It also highlights the need to consider different types of expression. For example, it is unclear whether similar effects would be found for positive expressions compared to pain. Given that exposure duration may be important, a related question is whether similar effects would be found for dynamic expressions. Indeed, the current study used static images, whereas expressions are dynamic and change over a short time frame. This is relevant to pain, especially since some have observed the counter-intuitive 'smile of pain' effect that can occur towards the end of a dynamic pain expression [40].

There are limitations with the current research, which need to be considered. We chose to use the dot probe task, and whilst commonly used, it has been questioned in terms of reliability in non-pain groups [14]. Bias indexes typically reflect relatively small differences in response times, and averaging across trials can hide within-trial variation. One option in the future would be to address both points, by taking a trial-by-trial approach [66]. We had a relatively small sample across each experiment, and so it is also possible the study was underpowered, especially in terms of between-groups effects. Rather than focusing exclusively on significance values, we could use the effect sizes presented here as a basis for determining appropriate samples sizes in future studies [42]. Other improvements would be to not rely on any one type of task, and there is a need to explore whether similar patterns are found using alternative approaches. Another issue is the applicability of the experimental paradigm used here to clinical pain experience. For example, acted expressions can be differentiated from naturally occurring expressions, and are clearly removed from real world experiences of interpersonal interactions. Similarly, the rapid deployment of expressions on a computer monitor is not typical of the way we experience day-to-day interpersonal interactions. However, this methodology still has a valid place in testing predictions, lays the foundations for more applied work, and brings a level of standardization and control that simply is not possible in the 'real world' [48].

Despite these limitations there are implications to consider, especially for future research. There are advantages in taking a carefully controlled, experimental approach to the measurement of attentional processes in pain expression decoding. This study demonstrates that by adopting standardized techniques to measure attentional biases, it is possible to investigate gender differences in a novel and interesting manner that goes beyond simple expression recognition paradigms. Future directions could include greater consideration of different forms of nonverbal communication. In addition to body postures, facial expressions and vocalizations are also important in pain. Future studies could not only consider different channels of pain communication, but also integrate these different cues. We still know very little about whether one channel dominates over others, and in turn whether gender plays a role. Outside of pain, there are suggestions that when multiple expression channel are compared, information from bodies can affect face expression recognition [16], and that there may be gender differences in recognition accuracy [13]. While the current study considered binary comparisons between men and women, we also need to acknowledge that gender is a more complex and multidimensional set of constructs, which could also affect the perception and understanding of pain expressions [6, 28-30]. We are also unaware of any study that has considered potential sex and gender interactions in the expression or recognition of pain and would welcome further research that explores this possibility in more detail.

Although it is unwise to generalize from these lab-based experiments to applied clinical settings, they do provide a foundation for investigating how gender-related biases may occur in contexts where the detection of pain expression is relevant to observer judgements or action. For example, it would be interesting to know whether such gender-based attentional biases lead to differences in the decisions made by carers and healthcare professionals. There is a small, but growing, literature that suggests this may be the case, with both attentional and interpretive biases potentially relevant to how observers process pain in others. Not only do carers of patients with pain exhibit attentional biases for painful facial expressions [46, 47], but it seems that healthcare providers differentially interpret male and female expressions of pain, which in turn may affect treatment decisions [55, 64]. Further work that brings these themes together and explores them in clinical contexts is warranted.

Acknowledgements

Some of the findings were presented at the British Pain Society meetings in 2016 and 2019, and abstracts based on these results published in the corresponding edition of the British Journal of Pain. The authors acknowledge the contribution of Grant Boyle who helped to collect the data described in Experiment 1. The images used in the study are available via the Bath Centre for Pain Research webpage: https://www.bath.ac.uk/research-centres/centre-for-pain-research-cpr/.

Figure Legends

Figure 1. Observer gender differences in the effect image exposure time has on attentional biases in Experiment 2

Figure 2. Observer gender differences in attentional bias toward fear and pain expressions in Experiment 3

Figure 3. Observer gender differences in the disengagement from male and female expressions in Experiment 3

References

1. Armony JL, Sergerie K. Own-sex effects in emotional memory for faces. *Neuroscience Letters*. 426:1-5, 2007

2. Attridge N, Crombez G, Van Ryckeghem D, Keogh E, Eccleston C. The experience of cognitive intrusion of pain: Scale development and validation. *Pain*. 156:1978-1990, 2015

3. Bar KJ, Greiner W, Letsch A, Kobele R, Sauer H. Influence of gender and hemispheric lateralization on heat pain perception in major depression. *Journal of Psychiatric Research*. 37:345-353, 2003

4. Baum C, Schneider R, Keogh E, Lautenbacher S. Different Stages in Attentional Processing of Facial Expressions of Pain: A Dot-Probe Task Modification. *Journal of Pain*. 14:223-232, 2013

5. Belin P, Fillion-Bilodeau S, Gosselin F. The Montreal affective voices: A validated set of nonverbal affect bursts for research on auditory affective processing. *Behav Res Methods*. 40:531-539, 2008

6. Boerner KE, Chambers CT, Gahagan J, Keogh E, Fillingim RB, Mogil JS. The conceptual complexity of gender and its relevance to pain. *Pain*. 159:2137-2141, 2018

7. Boerner KE, Chambers CT, McGrath PJ, LoLordo V, Uher R. The effect of parental modeling on child pain responses: The role of parent and child sex. *The Journal of Pain*. 18:702-715, 2017

8. Boichat C, Eccleston C, Keogh E. The tripartite structure of pain-related affect: A confirmatory factor analysis. *Psychology, Health & Medicine*. 23:1211-1222, 2018

9. Brookes ML, Sharpe L, Dear BF. Rumination induces a pattern of attention characterized by increased vigilance followed by avoidance of affective pain words. *European Journal of Pain*. 21:1197-1208, 2017

10. Carr AR, Scully A, Webb M, Felmingham KL. Gender differences in salivary alpha-amylase and attentional bias towards negative facial expressions following acute stress induction. *Cognition & Emotion.* 30:315-324, 2016

11. Cellerino A, Borghetti D, Sartucci F. Sex differences in face gender recognition in humans. *Brain Research Bulletin.* 63:443-449, 2004

12. Clarke PJF, MacLeod C, Guastella AJ. Assessing the role of spatial engagement and disengagement of attention in anxiety-linked attentional bias: A critique of current paradigms and suggestions for future research directions. *Anxiety Stress and Coping.* 26:1-19, 2013

13. Collignon O, Girard S, Gosselin F, Saint-Amour D, Lepore F, Lassonde M. Women process multisensory emotion expressions more efficiently than men. *Neuropsychologia.* 48:220-225, 2010

14. Crombez G, Van Ryckeghem DM, Eccleston C, Van Damme S. Attentional bias to pain-related information: A meta-analysis. *Pain.* 154:497-510, 2013

15. de Gelder B. Why bodies? Twelve reasons for including bodily expressions in affective neuroscience. *Philos T R Soc B.* 364:3475-3484, 2009

16. de Gelder B, Meeren HK, Righart R, van den Stock J, van de Riet WA, Tamietto M. Beyond the face: Exploring rapid influences of context on face processing. *Progress in Brain Research.* 155:37-48, 2006

17. Edwards R, Augustson E, Fillingim RB. Differential relationships between anxiety and treatment-associated pain reduction among male and female chronic pain patients. *Clinical Journal of Pain.* 19:208-216, 2003

18. Edwards R, Eccleston C, Keogh E. Observer influences on pain: An experimental series examining same-sex and opposite-sex friends, strangers, and romantic partners. *Pain.* 158:846-855, 2017

19. Fillingim RB. Individual differences in pain: Understanding the mosaic that makes pain personal. *Pain.* 158:S11-S18, 2017

20. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL, 3rd. Sex, gender, and pain: A review of recent clinical and experimental findings. *The Journal of Pain.* 10:447-485, 2009

21. Goos LM, Silverman I. Sex related factors in the perception of threatening facial expressions. *Journal of Nonverbal Behavior.* 26:27-41, 2002

22. Grafton B, MacLeod C. Enhanced probing of attentional bias: The independence of anxiety-linked selectivity in attentional engagement with and disengagement from negative information. *Cognition & Emotion.* 28:1287-1302, 2014

23. Hall JA. Gender effects in decoding nonverbal cues. *Psychological Bulletin.* 85:845-857, 1978

24. Hall JA: Women's and men's nonverbal communication: Similarities, differences, stereotypes, and origins. In: The SAGE handbook of nonverbal communication.(Manusov, V., Patterson, M.L., Eds.), Sage Publishers, London, 2006, pp. 208-218.

25. Hall JA, Horgan TG, Murphy NA. Nonverbal Communication. *Annual Review of Psychology.* 70:271-294, 2019

26. Herlitz A, Loven J. Sex differences and the own-gender bias in face recognition: A meta-analysis review. *Vis Cogn.* 21:1306-1336, 2013

27. Hirsh AT, Alqudah AF, Stutts LA, Robinson ME. Virtual human technology: Capturing sex, race, and age influences in individual pain decision policies. *Pain.* 140:231-238, 2008

28. Keogh E. Gender differences in the nonverbal communication of pain: A new direction for sex, gender, and pain research? *Pain.* 155:1927-1931, 2014

29. Keogh E. Men, masculinity, and pain. *Pain*. 156:2408-2412, 2015

30. Keogh E. The gender context of pain. *Health Psychology Review*. Epub ahead of print, doi: 10.1080/17437199.2020.1813602

31. Keogh E, Cheng F, Wang S. Exploring attentional biases towards facial expressions of pain in men and women. *European Journal of Pain*. 22:1617-1627, 2018

32. Keogh E, Ellery D, Hunt C, Hannent I. Selective attentional bias for pain-related stimuli amongst pain fearful individuals. *Pain*. 91:91-100, 2001

33. Keogh E, Hamid R, Hamid S, Ellery D. Investigating the effect of anxiety sensitivity, gender and negative interpretative bias on the perception of chest pain. *Pain*. 111:209-217, 2004

34. Keogh E, Hatton K, Ellery D. Avoidance versus focused attention and the perception of pain: Differential effects for men and women. *Pain*. 85:225-230, 2000

35. Keogh E, Herdenfeldt M. Gender, coping and the perception of pain. *Pain*. 97:195-201, 2002

36. Keogh E, McCracken LM, Eccleston C. Gender moderates the association between depression and disability in chronic pain patients. *European Journal of Pain*. 10:413-422, 2006

37. Koster EHW, Crombez G, Verschuere B, De Houwer J. Selective attention to threat in the dot probe paradigm: differentiating vigilance and difficulty to disengage. *Behaviour Research and Therapy*. 42:1183-1192, 2004

38. Kret ME, De Gelder B. A review on sex differences in processing emotional signals. *Neuropsychologia*. 50:1211-1221, 2012

39. Kunz M, Meixner D, Lautenbacher S. Facial muscle movements encoding pain-a systematic review. *Pain*. 160:535-549, 2019

40. Kunz M, Prkachin K, Lautenbacher S. The smile of pain. *Pain*. 145:273-275, 2009

41. LaFrance M, Hecht MA, Levy Paluck E. The contingent smile: A meta-analysis of sex differences in smiling. *Psychological Bulletin.* 129:305-334, 2003

42. Lakens D: Sample Size Justification. Available at: psyarxiv.com/9d3yf Accessed 22/4/21, 2021

43. Lovibond SH, Lovibond PF: Manual for the Depression Anxiety Stress Scales. 2nd edition, Psychology Foundation, Sydney, 1995.

44. McCracken LM, Houle T. Sex-specific and general roles of pain-related anxiety in adjustment to chronic pain: A reply to Edwards et al. *The Clinical journal of pain.* 16:275-276, 2000

45. McNeil DW, Rainwater AJ. Development of the fear of pain questionnaire-III. *Journal of Behavioral Medicine.* 21:389-410, 1998

46. Mohammadi S, Dehghani M, Khatibi A, Sanderman R, Hagedoorn M. Caregivers' attentional bias to pain: Does it affect caregiver accuracy in detecting patient pain behaviors? *Pain.* 156:123-130, 2015

47. Mohammadi S, Dehghani M, Sharpe L, Heidari M, SedaghatD M, Khatibi A. Do main caregivers selectively attend to pain-related stimuli in the same way that patients do? *Pain.* 153:62-67, 2012

48. Mook DG. In defense of external invalidity. *Am Psychol.* 38:379-387, 1983

49. Moore DM, Keogh E, Eccleston C. Headache impairs attentional performance. *Pain.* 154:1840-1845, 2013

50. Mounce C, Keogh E, Eccleston C. A principal components analysis of negative affect-related constructs relevant to pain: evidence for a three component structure. *The Journal of Pain.* 11:710-717, 2010

51. Pfabigan DM, Lamplmayr-Kragl E, Pintzinger NM, Sailer U, Tran US. Sex differences in event-related potentials and attentional biases to emotional facial stimuli. *Frontiers in psychology*. 5, 2014

52. Pintzinger NM, Pfabigan DM, Tran US, Kryspin-Exner I, Lamm C. Attentional biases in healthy adults: Exploring the impact of temperament and gender. *Journal of Behavior Therapy and Experimental Psychiatry*. 52:29-37, 2016

53. Riva P, Sacchi S, Montali L, Frigerio A. Gender effects in pain detection: Speed and accuracy in decoding female and male pain expressions. *European Journal of Pain*. 15, 2011

54. Samulowitz A, Gremyr I, Eriksson E, Hensing G. "Brave Men" and "Emotional Women": A theory-guided literature review on gender bias in health care and gendered norms towards patients with chronic pain. *Pain Research & Management*. 2018

55. Schafer G, Prkachin KM, Kaseweter KA, Williams AC. Health care providers' judgments in chronic pain: The influence of gender and trustworthiness. *Pain*. 157:1618-1625, 2016

56. Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment*. 7:524-532, 1995

57. Taylor S, Zvolensky MJ, Cox BJ, Deacon B, Heimberg RG, Ledley DR, Abramowitz JS, Holaway RM, Sandin B, Stewart SH, Coles M, Eng W, Daly ES, Arrindell WA, Bouvard M, Cardenas SJ. Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment*. 19:176-188, 2007

58. Todd J, van Ryckeghem DML, Sharpe L, Crombez G. Attentional bias to pain-related information: A meta-analysis of dot-probe studies. *Health Psychology Review.* 12:419-436, 2018

59. Tran US, Lamplmayr E, Pintzinger NM, Pfabigan DM. Happy and angry faces: Subclinical levels of anxiety are differentially related to attentional biases in men and women. *Journal of Research in Personality.* 47:390-397, 2013

60. Vigil JM. A socio-relational framework of sex differences in the expression of emotion. *Behavioral and Brain Sciences.* 32:375-390, 2009

61. Walsh J, Eccleston C, Keogh E. Pain communication through body posture: The development and validation of a stimulus set. *Pain.* 155:2282-2290, 2014

62. Walsh J, Eccleston C, Keogh E. Sex differences in the decoding of pain-related body postures. *European Journal of Pain.* 21:1668-1677, 2017

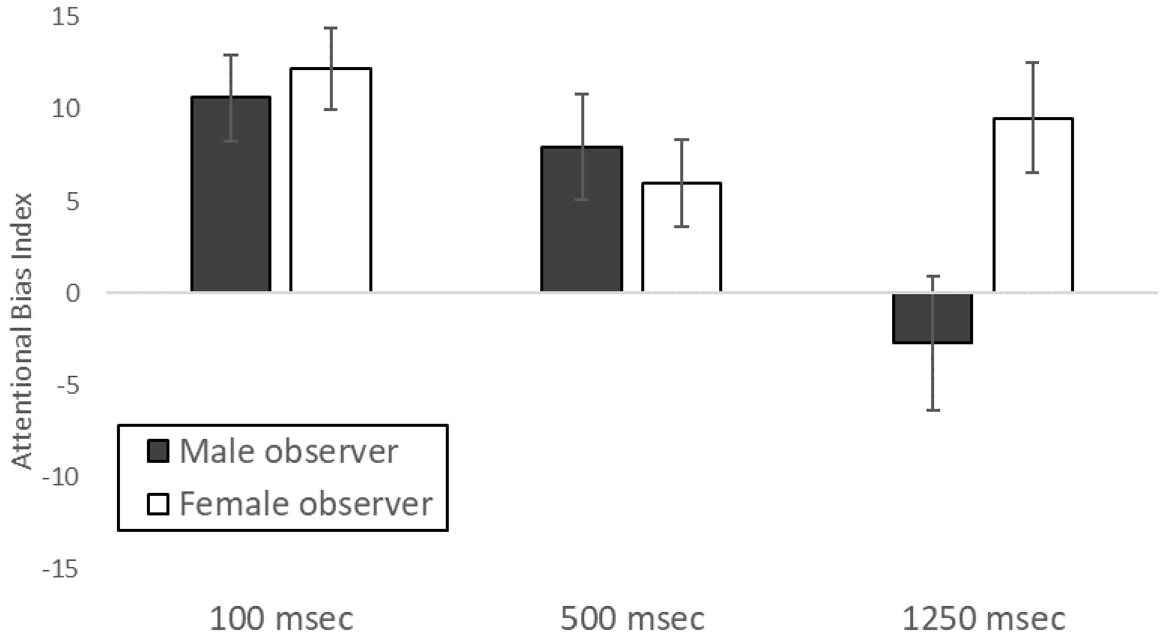
63. Walsh J, Eccleston C, Keogh E. Gender differences in attention to pain body postures in a social context: a novel use of the bodies in the crowd task. *Pain.* 161:1776-1786, 2020

64. Wandner LD, George SZ, Lok BC, Torres CA, Chuah JH, Robinson ME. Pain assessment and treatment decisions for virtual human patients. *Cyberpsych Beh Soc N.* 16:904-909, 2013

65. Wesolowicz DM, Clark JF, Boissoneault J, Robinson ME. The roles of gender and profession on gender role expectations of pain in health care professionals. *Journal of Pain Research.* 11:1121-1128, 2018

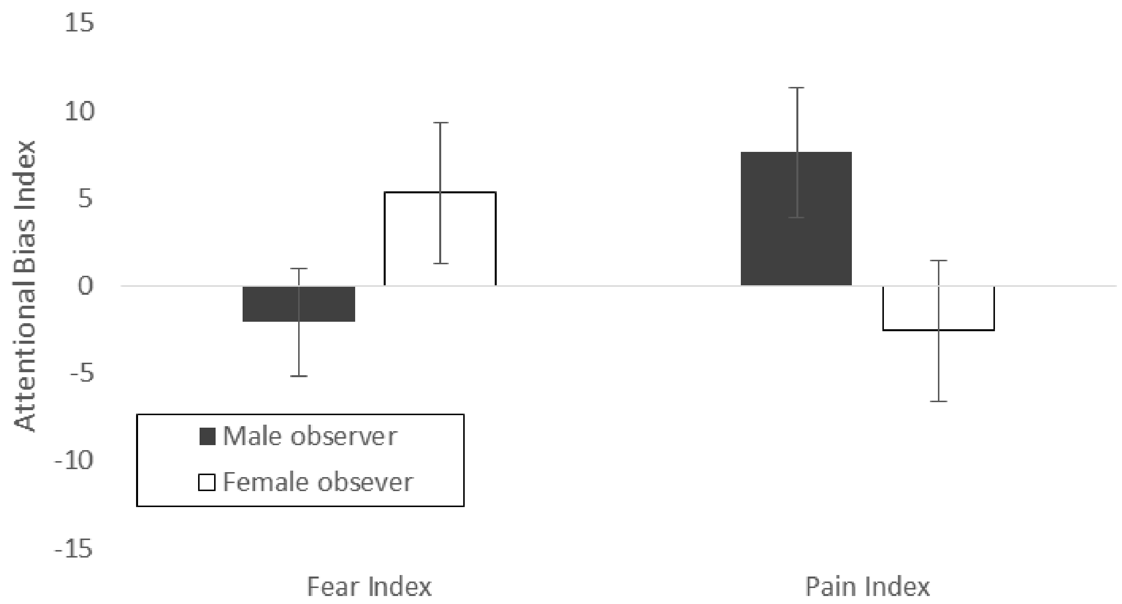
66. Zvielli A, Bernstein A, Koster EHW. Temporal Dynamics of Attentional Bias. *Clin Psychol Sci.* 3:772-788, 2015

Figure 1. Observer gender differences in the effect image exposure time has on attentional biases in Experiment 2



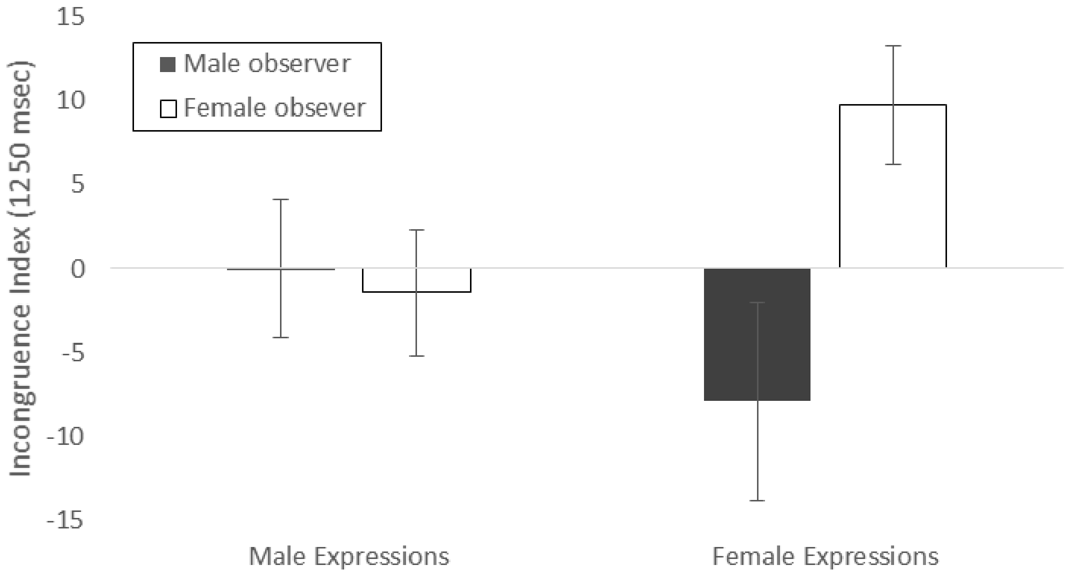
Note. A positive score is taken to indicate a biases towards the location of target expressions, whereas a negative score is indicative of an attentional bias away from such expressions.

Figure 2. Observer gender differences in attentional bias toward fear and pain expressions in Experiment 3



*Note***.** A positive score is taken to indicate a biases towards the location of target expressions, whereas a negative score is indicative of an attentional bias away from such expressions

Figure 3. Observer gender differences in the disengagement from male and female expressions in Experiment 3



Note. A positive score is taken to indicate greater time to disengage, whereas a negative value reflects a greater ability to disengage from target expressions.

Table 1

Means and Standard Deviations for attentional bias index in male and female participants, by gender of actor and expression type for Experiment 1. Combined means and one-sample tests comparing combined mean to zero.

		Male Observer		Female Observer		Combined	One-sample t-test
		M	*SD*	*M*	*SD*	*M*	*t*
Male Actor	Fear Index	2.80	23.72	1.72	21.07	2.27	.64
	Sadness Index	3.67	19.70	2.00	17.66	2.86	.97
	Pain Index	14.74	21.51	10.62	31.89	12.73	2.97**
Female Actor	Fear Index	3.22	17.32	0.69	22.28	1.99	.63
	Sadness Index	-0.69	25.95	-12.12	21.97	-6.26	1.60
	Pain Index	9.48	18.27	-7.68	23.30	1.12	.31

Note: * $p<.05$; ** $p<.01$; *** $p<.001$.

Table 2

Means and Standard Deviations for attentional bias index for male and female participants, by presentation time, gender of actor, and expression type in Experiment 2. Combined means and one-sample tests comparing combined mean to zero.

			Male Observer		Female Observer		Combined	One-sample t-test
			M	*SD*	*M*	*SD*	*M*	*t*
100 ms								
-	Male Actor	Fear Index	15.24	(23.68)	17.43	(17.53)	16.43	5.48***
		Sadness Index	3.38	(18.20)	9.38	(23.40)	6.642	2.13*
		Pain Index	8.23	(23.98)	19.48	(30.52)	14.35	3.47**
-	Female Actor	Fear Index	9.05	(20.53)	6.67	(28.46)	7.76	2.11*
		Sadness Index	8.65	(24.14)	7.49	(16.98)	8.02	2.68***
		Pain Index	19.05	(32.43)	12.68	(23.31)	15.59	3.82***
500 ms								
-	Male Actor	Fear Index	7.72	(27.13)	.28	(21.19)	3.68	1.04
		Sadness Index	9.00	(25.57)	5.78	(36.14)	7.25	1.56
		Pain Index	12.53	(28.11)	12.91	(37.92)	12.74	2.58**
-	Female Actor	Fear Index	9.76	(23.60)	3.37	(30.13)	6.29	1.57
		Sadness Index	-2.37	(22.23)	3.49	(23.22)	.82	.24

		Pain Index	10.98	(21.43)	9.85	(23.64)	10.37	3.14**
1250 ms								
-	Male Actor	Fear Index	-16.04	(33.59)	.73	(30.03)	-6.92	-1.45
		Sadness Index	-7.77	(55.57)	7.17	(38.78)	.35	.05
		Pain Index	6.73	(20.71)	14.88	(28.04)	11.16	3.02**
-	Female Actor	Fear Index	3.66	(53.17)	14.73	(28.89)	9.68	1.58
		Sadness Index	-7.87	(45.84)	13.58	(29.27)	3.79	.66
		Pain Index	5.08	(29.12)	5.95	(32.14)	5.56	1.24

Note: * p<.05; ** p<.01; *** p<.001.

Table 3

Means and Standard Deviations for attentional bias index for male and female participants, by presentation time, gender of actor, and expression type in Experiment 3. Combined means and one-sample tests comparing combined mean to zero.

		Male Observer		Female Observer		Combined	One-sample t-test
		M	*SD*	*M*	*SD*	*M*	*t*
150 ms							
- Male Actor	Fear Index	5.11	(33.36)	14.28	(50.30)	9.79	1.61
	Pain Index	12.78	(30.45)	-3.31	(34.77)	4.57	.96
- Female Actor	Fear Index	-3.84	(35.85)	6.61	(40.75)	1.49	.27
	Pain Index	-0.96	(31.92)	-1.50	(49.13)	-1.24	.21
1250 ms							
- Male Actor	Fear Index	9.70	(31.06)	-1.22	(28.58)	4.13	.96
	Pain Index	12.54	(34.60)	-5.02	(26.98)	3.58	.79
- Female Actor	Fear Index	-19.21	(42.35)	1.61	(31.33)	-8.59	1.57
	Pain Index	6.08	(29.32)	-0.43	(34.49)	2.76	.61

Note. * p<.05; ** p<.01; *** p<.001.

Table 4

Means and Standard Deviations for congruency index for male and female participants, by presentation time, gender of actor, and expression type in Experiment 3. Combined means and one-sample tests comparing combined mean to zero.

		Male Observer		Female Observer		Combined	One-sample t-test
		M	*SD*	*M*	*SD*	*M*	*t*
150 ms							
- Male Actor	Fear Index	-2.67	(25.94)	-1.49	(34.93)	-2.06	.47
	Pain Index	-13.91	(32.04)	-7.12	(26.12)	-10.44	2.52*
- Female Actor	Fear Index	8.95	(28.51)	-4.98	(34.77)	1.84	.40
	Pain Index	1.22	(25.51)	0.70	(39.06)	.96	.21
1250 ms							
- Male Actor	Fear Index	-7.82	(25.75)	3.77	(30.72)	-1.90	.47
	Pain Index	-14.42	(34.01)	-0.43	(35.69)	-7.29	1.45
- Female Actor	Fear Index	5.40	(35.59)	8.05	(23.45)	6.75	1.59
	Pain Index	-8.09	(26.21)	10.20	(37.23)	1.24	.26

Note. * p<.05; ** p<.01; *** p<.001.

Table 5

Means and Standard Deviations for incongruency index for male and female participants, by presentation time, gender of actor, and expression type in Experiment 3. Combined means and one-sample tests comparing combined mean to zero.

			Male Observer		Female Observer		Combined	One-sample t-test
			M	*SD*	*M*	*SD*	*M*	*t*
150 ms								
-	Male Actor	Fear Index	2.44	(36.82)	12.80	(47.32)	7.73	1.28
		Pain Index	-1.13	(27.91)	-10.43	(40.76)	-5.88	1.16
-	Female Actor	Fear Index	5.11	(23.06)	1.63	(28.13)	3.33	.91
		Pain Index	0.26	(36.43)	-0.80	(38.44)	-.28	.05
1250 ms								
-	Male Actor	Fear Index	1.88	(23.28)	2.55	(28.69)	2.22	.60
		Pain Index	-1.89	(26.17)	-5.45	(26.66)	-3.70	.99
-	Female Actor	Fear Index	-13.81	(30.33)	9.66	(29.11)	-1.84	.41
		Pain Index	-2.02	(38.90)	9.77	(22.89)	4.00	.88

Note. * p<.05