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Attentional processing of other's facial display of pain: An eye tracking study ☆

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ABSTRACT

The present study investigated the role of observer pain catastrophizing and personal pain experience as possible moderators of attention to varying levels of facial pain expression in others. Eye movements were recorded as a direct and continuous index of attention allocation in a sample of 35 undergraduate students while viewing slides presenting picture pairs consisting of a neutral face combined with either a low, moderate, or high expressive pain face. Initial orienting of attention was measured as latency and duration of first fixation to 1 of 2 target images (i.e., neutral face vs pain face). Attentional maintenance was measured by gaze duration. With respect to *initial orienting to pain*, findings indicated that participants reporting low catastrophizing directed their attention more quickly to pain faces than to neutral faces, with fixation becoming increasingly faster with increasing levels of facial pain expression. In comparison, participants reporting high levels of catastrophizing showed decreased tendency to initially orient to pain faces, fixating equally quickly on neutral and pain faces. Duration of the first fixation revealed no significant effects. With respect to *attentional maintenance*, participants reporting high catastrophizing and pain intensity demonstrated significantly longer gaze duration for all face types (neutral and pain expression), relative to low catastrophizing counterparts. Finally, independent of catastrophizing, higher reported pain intensity contributed to decreased attentional maintenance to pain faces vs neutral faces. Theoretical implications and further research directions are discussed.

1. Introduction

The intrinsic threat value of pain serves adaptive functions by drawing upon attentional resources and motivating action to escape, reduce, or avoid tissue damage [11,59]. The function of pain to demand attention and interrupt ongoing activity is well documented in clinical and nonclinical populations [12,43,57,58]. Pain may likewise serve protective functions in the interpersonal context by impelling expressive pain behaviors that attract the attention of others, thereby initiating concern and care [9,18,21,34,64]. Despite the importance of attention for observer responses, few studies have investigated observers' attentional processing of others' pain [24,36,60,61].

In line with the intrapersonal pain literature, studies of interpersonal attention to pain highlight the role of both bottom-up (e.g., pain expressiveness of the person in pain) and top-down variables (e.g., observer pain catastrophizing and pain experience) known to amplify the threat value of pain. Studies using the dot-probe paradigm show that high-fear chronic pain patients [24,36] and their caregivers [36] selectively shift attention toward pain faces. Using dot-probe and visual search paradigms, Vervoort et al. [60,61] similarly found higher attentional allocation among parents with a strong tendency to catastrophize about pain toward higher child pain expression.

Existing studies of attentional bias towards personal and others' pain have significant limitations. First, existing paradigms examine attentional processing indirectly via registration of manual reaction times. Second, current methodology does not permit assessment of continuous attentional processing and thus does not allow distinction between initial attentional allocation and subsequent maintenance of attention to stimuli. This distinction is theoretically and clinically important, as current intrapersonal literature supports that, particularly among individuals who catastrophize about pain [57,58] or report intense pain [12,31], attentional disruption by pain originates mainly from difficulties in attentional *disengagement* rather than initial attentional allocation [31,44,57]. This literature thus points to the importance of

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attentional maintenance vs initial orienting to pain. In the context of *inter*personal pain experience, evidence of similar disengagement difficulty (reflecting attentional maintenance processes) would suggest excessive cognitive processing of threat as well as potential problems in attention and emotion regulation.

Eye-tracking technology provides an intuitive and ecologically valid method to directly examine attentional processes over time, thus addressing the above issues [16,62,66]. The current study employed eye-tracking methodology to assess the impact of both observer characteristics and characteristics of the person observed upon attention to pain in others. Specifically, we examined the role of observers' pain catastrophizing and personal pain experience as possible moderators of attention to varying levels of facial pain expression. Initial orienting of attention was measured as latency to first fixation to 1 of 2 target images (i.e., neutral face vs pain face) and the duration of this first fixation. Subsequent attentional processing (i.e., attentional maintenance) was measured by gaze duration. We expected that higher levels of pain catastrophizing and personal pain experience would be associated with greater attention to pain faces, particularly in the case of greater facial pain expressiveness. Additionally, we explored whether observers' attentional processing of others' pain was characterized by initial orienting to pain and/or maintained attention.

2. Method

2.1. Participants

A total of 55 undergraduate psychology students from Ghent University participated for course credits or received financial compensation. Descriptive statistics of sociodemographic and pain-related variables of the participant sample are shown in Table 1. All participants provided informed consent and were free to terminate the experiment at any time. The study was approved by the ethics committee of the Faculty of Psychology and Educational Sciences of Ghent University.

2.2. Materials

The stimulus set consisted of 32 pictures of 8 adult faces (4 male and 4 female). All pictures were drawn from 1-s video clips of simulated facial expressions of pain taken from a larger collection of such stimuli previously created and validated in the laboratory by Simon et al. [47], who provided permission for using these stimuli. For these stimuli, 8 actors were videotaped while producing neutral facial expression displays (NFE) and simulated facial expressions of pain at 3 different levels: low (LFE), moderate (MFE), and high (HFE) facial expression of pain. Using these 32 pictures, a series of 3 different pairs were generated, resulting in 24 study slides (Fig. 1). Each slide consisted of 2 pictures of the same adult presenting a neutral face (NFE) combined with either 1) a simulated low expressive pain face (LFE); 2) a moderate expressive pain face (MFE); or 3) a high expressive pain face (HFE). Pairs were compiled twice such that the neutral expression appeared equally often on the left and right side. Using the Facial Action Coding System [14], these video clips were previously reliably coded on occurrence and intensity of facial expression of pain [47].

To further determine the validity of the pain expression categories (i.e., NFE, LFE, MFE, and HFE), 20 independent judges (10 male, 10 female; age range 22–66 years; M = 35.8 years, SD = 13.53) rated the 32 pictures on pain intensity using a 0–10 numerical rating scale (NRS). Analysis of variance (ANOVA) indicated significant differences in picture ratings between different sets [$F(3,17) = 254.29$, $P < 0.0001$]. Specifically, contrast analyses revealed that judges' pain ratings of high expressive pain faces (M = 7.59, SD = 1.30) were significantly higher than ratings of moderate expressive pain faces [M = 5.83, SD = 1.69; $F(1, 19) = 747.32$, $P < 0.0001$]. Moderate expressive pain faces were rated significantly higher in pain intensity than low expressive pain faces [M = 3.98, SD = 1.70; $F(1,19) = 256.85$, $P < 0.0001$] and low expressive pain faces were rated significantly higher in pain intensity than neutral faces [M = .75, SD = .76; $F(1,19) = 97.92$, $P < 0.0001$].

Table 1
Descriptive statistics of demographic and pain-related variables.

Measure	M	SD	n	%
Age (years)	19.85	4.54	–	–
Sex				
Female	–	–	49	89
Male	–	–	6	11
Marital status				
In a relationship	–	–	25	45.45
Married or co-habiting	–	–	0	0
Single	–	–	29	52.72
Divorced	–	–	1	1.81
Nationality				
Belgian	–	–	51	
Dutch	–		3	
German	–	–	1	
Having had pain during past 3 months	–	–	38	69.09
Number of days in pain during past 3 months	14.03	16.32	–	–
Location of most salient pain complaint during past 3 months				
Head	–	–	12	32.43
Stomach	–	–	6	16.22
Back/neck	–	–	6	16.22
Throat			4	10.81
Legs/feet			8	21.62
Arms			1	2.70
Current level of pain (NRS 0–10)	2.18	2.40	–	–
Average level of pain experienced during past 3 months (NRS 0–10)	2.76	2.46	–	–

NRS = numerical rating scale.