Freeze!
Social modulation of defensive responses in a threatening, pain-relevant context

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Background
Social context affects an individual's experience, interpretation, communication and appraisal of pain. What about defensive responses to pain?

Freeze is a defensive response to threat characterized by reduced body motion, a tense body posture and decreased heart rate. Unpleasant films and social threat lead to freezing-like responses in humans.

Anticipation of pain leads to freezing in animals.

Social threat leads to inhibition of painful facial expression.

Does social context modulate freezing-like responses in a painful context?

Hypotheses
While anticipating pain, a threatening social context, compared to a safe social context, will lead to more freeze-like responses such as:
1. Reduced body sway
2. Decreased heart rate (tachycardia)
3. Reduced painful facial expressions

Methods
N = 39 healthy participants (21 = 31, Mage = 22.79 years, SDage = 3.07 years)

Simuli and apparatus
- Neurocom Clinical Research System

Participants stood on a stabilometric force platform (see Fig. 1) which is used to measure center of pressure (COP) excursions in the anterior-posterior (AP) and medio-lateral (ML) directions (see Fig. 2).

Painful stimulus (pain-US)
Electrocutaneous stimulation to the wrist of the dominant hand (M = 33.21 mA, SD = 20.04) was used as unconditional stimulus.

Auditory cue (CS)
An auditory cue served as conditional stimulus, predicting the occurrence of the pain-US with a 50% reinforcement rate.

Social context manipulation
20 (10 male) angry and happy facial stimuli were used to create a threatening and safe social context (see Fig. 3).

Design and procedure
Participants stand on the force platform, watching a sequence of images on the monitor.

Threatening context: SCI (5 rpm), no CS
SAFE context: SCI (5 rpm), no CS

N = 39
2x10 CS x 10 x CS

Table 1 CS and no CS, respectively, refer to trials with the CS (auditory cue) which was followed after 2 s by the pain-US (50% reinforcement), and trials without the CS and no pain-US. Threat and safe context, respectively, refer to the threatening social context (angry facial stimuli), and the safe social context (happy facial stimuli). Note that the order of the threatening and safe contexts was counterbalanced across participants.

Main outcomes

Painful facial expression: A webcam was used to record participants' facial expression, which were then rated by an experimenter on the 0-10 scale.

Heart rate: A polar watch (Polar Electro Oy, Finland) was used to record participants' heart rate (beats per minute).

Body sway: Center of pressure (COP) excursions in the AP and ML directions were recorded to compute body sway.

Results

Manipulation check

Ratings of facial stimuli

Valence: Anger > Happy
Arousal: Anger > Happy
Threatness: Anger > Happy

No differences in pain intensity or pain unpleasantness ratings (F(1) = .01).

Pain expectancy ratings were higher in the threatening context than in the safe context (Main effect Context, F(1, 35) = 5.87, p = .02, ηp² = .14). Moreover, successful differentiation between CS and no CS (Stimulus type x Block, F(2, 70) = 4.87, p = .01, ηp² = .23) was found (see Figure 5).

No differences in pain intensity or pain unpleasantness ratings (F(1) = .20).

Discussion

A threatening social context led to:
1. Increased pain expectancy ratings
2. Reduced heart rate (tachycardia) in highly anxious individuals
3. Reduced painful facial expression in highly anxious individuals

Social context did not affect body sway, pain intensity ratings or pain unpleasantness ratings.

We found limited evidence that social threat facilitates freezing-like responses to pain, with the prominent exception of body sway, especially so for individuals with high trait anxiety. This study provides further evidence that social context can modulate pain-relevant processes and should be considered in the study and treatment of acute and chronic pain.

References


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See Figure 2 for box plots of mean pain expectancy ratings (0-10) in the threatening and safe contexts across the three blocks.

Figure 2 A fear-related emotional faces database.

Figure 3 Exemplary angry and happy facial stimuli from the Karoš et al. (2015) database.

Figure 4 Changes in pain expectancy ratings (0-10) in the threatening and safe conditions across the three blocks.

Figure 5 Figure 5 shows the mean pain expectancy ratings (0-10) for the threatening context (Angry CS) and the safe context (Happy CS), respectively.

Figure 6 Figure 6 shows mean pain expectancy ratings (0-10) in the threatening context (Angry CS) and the safe context (Happy CS), respectively.