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Pain communication through body posture: The development and validation of a stimulus set

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ABSTRACT

Pain can be communicated nonverbally through facial expressions, vocalisations, and bodily movements. Most studies have focussed on the facial display of pain, whereas there is little research on postural display. Stimulus sets for facial and vocal expressions of pain have been developed, but there is no equivalent for body-based expressions. Reported here is the development of a new stimulus set of dynamic body postures that communicate pain and basic emotions. This stimulus set is designed to facilitate research into the bodily communication of pain. We report a 3-phase development and validation study. First 16 actors performed affective body postures for pain, as well as happiness, sadness, fear, disgust, surprise, anger, and neutral expressions. Second, 20 observers independently selected the best image stimuli based on the accuracy of emotion identification and valence/arousal ratings. Third, to establish reliability, this accuracy and valence rating procedure was repeated with a second independent group of 40 participants. A final set of 144 images with good reliability was established and is made available. Results demonstrate that pain, along with basic emotions, can be communicated through body posture. Cluster analysis demonstrates that pain and emotion are recognised with a high degree of specificity. In addition, pain was rated as the most unpleasant (negative valence) of the expressions, and was associated with a high level of arousal. For the first time, specific postures communicating pain are described. The stimulus set is provided as a tool to facilitate the study of nonverbal pain communication, and its possible uses are discussed.

1. Introduction

Pain is not only a sensory and emotional experience, but also a social-communicative event [13,14,31]. Being able to accurately communicate one's internal state is essential to survival [52]. Accordingly, humans must be able to encode, transmit, and decode affective information, including pain. Multiple channels are available for use, including aspects of voice, face, and bodily posture [26]. However, this is not straightforward, as information loss and interference in the encoding/decoding process can occur through a variety of sources, including context, individual characteristics of observers and communicators, and communication clarity.

Nonverbal pain communication has attracted significant clinical attention, especially around accurate observer ratings in assessment and treatment of pain in the preverbal [25,37] or no-longer verbal [17,44]. The success of nonverbal communication is governed by standard features including cue intensity, valence, salience, and context [7,34]. Observers' judgements of pain are differentially influenced by verbal and nonverbal communication, with nonverbal expression often perceived as more reflexive and honest, free of the influences of artefact or experience that affect verbal pain representations [12,14].

Experimental work has also played a role in shaping our understanding of pain communication, with most focusing on facial expressions. The introduction in 1976 [19] of the first widely used affective picture set for use in experimental studies (Pictures of Facial Affect [POFA]) provided a springboard for research into the facial communication of emotion, and later of pain [6,9,12,32,33,35,38,40,43]. Pain communication through facial expression is well established, and a prototypical facial expression has been described and validated [14,30,49]. Research has also established that humans can be trained to differentiate between spontaneous and acted pain facial expressions, with mixed success [3]. Although

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arguably not an emotion, pain also appears to have a unique communication signature that is well identified and replicated.

Pain can be expressed through other channels, including the body. Although Ekman's 6 basic emotions (anger, happiness, fear, disgust, surprise, and sadness) have been considered in posture research [11,18,48], and judgements of pain on walking have been investigated [8,27,28], most studies focus on clinical observational tools [25,37]. This dearth of research is surprising, given the wider range of methods that could be used, as well as evidence that body posture may be more indicative of pain than facial expressions [2]. For example, although some have considered the potential communicative effect of body posture, such as work by Sullivan et al. [45], little research has used specific, isolated, body posture stimuli for the examination of the communicative function of postural changes.

This lack of research may be due to the scarcity of evidence suggesting a communicative function of pain body posture, as well as the absence of a psychometrically sound set of stimuli. Creation of such stimuli will facilitate the examination of pain communication through body posture, and what influences this communication. This study aims to investigate the extent to which postural pain behaviours serve a communicative function, while also creating and validating a set of dynamic body posture stimuli.

2. Methods and results

2.1. Phase 1: stimulus creation and posture definition

The study was conducted in 3 phases. In phase 1, potential stimuli were created. In phase 2, the stimuli were presented to participants who rated them for affective content to reduce the images to a core set. In phase 3, a replication was undertaken, using only the core set of stimuli for further validation. Ethical approval for the whole study, including all 3 phases, was granted by the University of Bath Department of Psychology and Department for Health.

For the purposes of the research that we present here, "body posture" is defined as the position of the body, or parts of the body [26]. This includes the position of body parts in relation to each other at any given time, but does not include movements. "Communicative body posture" is defined as any body posture that communicates information to an observer, whether intentionally or unintentionally.

2.1.1. Participants

Nineteen amateur actors and dancers (10 male; age range 20–26; average age, 23.68 years; standard deviation [SD] = 2.62) were recruited. All were performers drawn from the amateur dance and dramatics societies at the University of Bath. Each actor provided informed consent and agreed to the use of their image in the stimulus set. Participants were reimbursed for their participation. All were required to be pain free, and free also of prescribed medication, and were to have not ingested alcohol for 24 hours before filming. All 19 met these criteria.

2.1.2. Stimulus creation

All filming took place in a television studio at the University of Bath. Lighting in the studio was kept constant throughout filming. Each actor performed in front of a plain white backdrop curtain, and wore plain black clothing (T-shirt and trousers). A Sony HDR PJ250E video camera, mounted on a Sony VCT-R640 Tripod, was used. The position and angle of the camera were fixed throughout filming. For each participant, different levels of zoom were used to ensure that they occupied the same screen space, regardless of individual height and weight.

Each actor stood at the same location in the studio in front of the plain white backdrop, facing 45° away from head-on to the camera, facing to the left of camera (their right). A frontal view (as opposed to a view based on a view of the actor's back) was chosen because previous research has demonstrated that emotions are optimally judged from such angles [11]. Fig. 1 presents an example of the final layout of the stimuli in 25-frame increments.

During filming, each actor first adopted a neutral posture, with back straight, head aligned to the body, arms by the sides, and feet approximately shoulder-width apart (termed the anatomic standard position). From this neutral position, they moved to the communicative posture and held it until directed to stop; this allowed researchers to edit the stimuli for length without losing any affective content.

Actors were directed in the final posture that they would adopt for each core emotion (happiness, sadness, fear, anger, disgust, and surprise) by the researchers. Postures for the basic emotions were directed based on previous research regarding emotion communication [1,11,48], which has found specific actions and exemplar body posture configurations that communicate each emotion. Pain postures were directed based on previous evidence examining pain behaviours [29,39]. Researchers chose to direct postures (see below) to ensure that final stimuli conformed to a uniform set of general rules, such as length of stimulus, distance moved by actors, and restrictions on actions. Furthermore, their movements were directed by the researchers for speed and fluency. The exact movement and timing of each posture other than those directed were left to the actors themselves, to ensure that movement sequence was natural both to the actors and to any audience.

Previous research [3,42] has established that there are potential limitations to the use of posed nonverbal expressions for both emotions and pain over spontaneous, natural expressions, and in creating the stimuli presented here we were aware of these limitations. However, in the interests of maintaining a high level of control over the stimuli created, and ensuring consistent dimensions for presentation, it was decided that directing and tightly controlling the stimuli created afforded the researchers the best opportunity to examine pain and emotion expressions in body postures.

Alternative strategies for examining pain communications may have been through the use of an observational design, examining real-life spontaneous pain expressions. Although this would have been a valid method for examining how the body communicates pain, this would not have afforded the researchers the same level

Fig. 1. An example of a directed pain stimulus, with images taken every 25 frames (running from left to right, starting at frame 1).