Communicative dimensions of pain catastrophizing: social cueing effects on pain behaviour and coping

Michael J.L. Sullivan\textsuperscript{a,*}, Heather Adams\textsuperscript{a}, Maureen E. Sullivan\textsuperscript{b}

\textsuperscript{a}Département de Psychologie, Université de Montréal, C.P. 6128 Succ. Centre Ville, Montreal, Que., Canada H3C 3J7
\textsuperscript{b}Fenwick Psychological and Health Consultants, Halifax, NS, Canada

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Abstract

The study was designed to assess whether the social context of a pain experience impacted on the relation between catastrophizing and duration of pain behaviour. Based on a communal coping model, the prediction was that the presence of an observer during a pain procedure would differentially influence the display of pain behaviour in high and low catastrophizers. University undergraduates taking part in a cold pressor procedure were randomly assigned to one of two conditions: (1) participant alone (n = 30); or (2) observer present (n = 34). Analysis of video records revealed that high pain catastrophizers displayed communicative pain behaviours (e.g. facial displays, vocalizations) for a longer duration when an observer was present compared to high pain catastrophizers who were alone during the pain procedure. The duration of pain management behaviours (e.g. holding, rubbing) did not vary significantly as a function of catastrophizing. When the observer was present, high catastrophizers also reported using fewer cognitive coping strategies than low catastrophizers. The pattern of findings suggests that in the presence of an observer, high pain catastrophizers show a propensity to engage in strategies that more effectively communicate their pain, and are less likely to engage in strategies that might minimize pain. Theoretical implications of the findings are discussed.

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1. Introduction

Catastrophizing has been defined as “an exaggerated negative mental set brought to bear during actual or anticipated painful experience” (Sullivan et al., 2001). Individuals who score high on measures of pain catastrophizing report more intense pain (Keefe et al., 1989; Sullivan et al., 1995) and show higher levels of pain behaviour and disability (Keefe et al., 2000; Sullivan and Stanish, 2003; Sullivan et al., 1998).

It has been suggested that high pain catastrophizers might engage in exaggerated displays of their pain-related distress as a means of coping with pain (Sullivan et al., 2000, 2001). This ‘communal coping’ model of pain catastrophizing draws on recent theoretical discussions of the interpersonal dimensions of coping, suggesting that individuals differ in the degree to which they adopt relational goals in their efforts to cope with stress (Coyne and Fiske, 1992; Lyons et al., 1995; Sullivan et al., 2000; Taylor, 2000; Thorn et al., 2003). Displays of distress can be used, consciously or unconsciously, to maximize proximity, or to solicit assistance or empathic responses from others in the social environment.

Pain behaviour has been discussed as the vehicle through which pain catastrophizers might elicit proximity, support or assistance from others (Keefe et al., 2000; Sullivan et al., 2000, 2001). Pain behaviour refers to a variety of actions or postural displays that are enacted during the experience of pain (Craig, 1999; Fridlund, 1994; Hadjistravropoulos and Craig, 2002; Prkachin and Craig, 1995).

A case can be made for distinguishing between pain behaviours that have a primary communicative function and pain behaviours that have a primary pain management function (Prkachin, 1986). Facial displays or vocalizations are likely to have a primary communicative function (Prkachin and Craig, 1995). Facial displays and vocalizations can communicate distress to observers but these behaviours do not have an obvious direct pain management function. However, behaviours such as rubbing or holding...
can serve a pain management function by protecting the affected body area, or by minimizing pain through mechanisms associated with tactile stimulation or increased circulation.

1.1. The present study

Based on a communal coping model, the prediction was that high pain catastrophizers would express pain behaviour for a longer duration when an observer was present compared to high pain catastrophizers who were alone during a painful procedure. Social context was not expected to influence the expressive displays of individuals with low scores on a measure of catastrophizing. The present study further examined whether pain management behaviours and communicative pain behaviours were differentially affected by the presence of an observer.

Also of interest was the effect of social context on the use of cognitive coping strategies. Proceeding from a communal coping perspective, the use of strategies to minimize pain may be at odds with the goals of soliciting assistance or maintaining proximity of others. As such, high pain catastrophizers might be less likely to use cognitive coping strategies in the presence of an observer.

2. Methods

2.1. Participants

A sample of 64 (26 men, 38 women) university undergraduates participated in the research. Participants responded to advertisements placed on the Introductory Psychology Web Site at Dalhousie University. A telephone screening interview was used to identify and exclude potential participants who were suffering from a pain-related condition (e.g. migraine, back pain, herpes, arthritis) or a medical condition that might be adversely affected by the pain procedure (e.g. cardiovascular problems, asthma, previous frostbite).

The mean age of the participant sample was 20.1 years with a range of 17–30 years (SD = 2.5). Participants were randomly assigned to one of two conditions: (1) participant alone (n = 30), or (2) observer present (n = 34). Participants were classified as high catastrophizers (n = 32) or low catastrophizers (n = 32) based on a median split (median = 18) of scores on the Pain Catastrophizing Scale (PCS; Sullivan et al., 1995). Students participated in exchange for course credit.

2.2. Apparatus

A cold pressor apparatus was used to induce pain. The apparatus consisted of a refrigerated unit (30 × 40 × 30 cm³) that maintained circulating water at 2 °C. A moveable armrest was used to immerse participants’ non-dominant arm in the cold water.

2.3. Measures

2.3.1. Pain

A 11-point scale with the endpoints no pain at all (0) and extreme pain (10) was positioned on the wall directly in front of the participant. Participants were prompted by a recording to provide verbal ratings of their pain at 20, 40, and 60 s of the water immersion period, and at 30 and 60 s of the first minute post-immersion.

2.3.2. Catastrophizing

The Pain Catastrophizing Scale (PCS) (Sullivan et al., 1995) was used as a measure of catastrophic thinking related to pain. The PCS contains 13 items describing different thoughts and feelings associated with pain experience. On this scale, respondents are asked to choose a number ranging from 0 (not at all) to 4 (all the time) to describe the frequency with which they experience different thoughts and feelings associated with pain. Numerous investigations have supported the reliability and validity of the PCS as a measure of pain-related catastrophic thinking (Sullivan et al., 1995, 2000; Osman et al., 2000; Van Damme et al., 2002).

2.3.3. Pain behaviour

A video camera was positioned behind a screen to record participants’ behaviour during the cold pressor procedure. Participants were aware they were being video taped but they could not see the camera. Video records were obtained for the 1 min water immersion period, and for the first minute following the water immersion.

Two trained coders, blind to experimental hypotheses and participants’ scores on the PCS, independently coded each video record for instances of pain behaviour according to a modification of procedures described in previous research on pain behaviour coding (Follick et al., 1985; Keefe and Block, 1982; Prkachin et al., 2002; Romano et al., 1991; Sullivan et al., 2000). Coders followed the guidelines described in a coding manual previously developed in our laboratory and received training using video records from previous studies until a criterion of 80% correct classification was obtained (Sullivan et al., 2000). Coders recorded the frequency and duration of the following pain behaviours: (1) facial expressions such as grimacing or wincing, (2) paraverbal pain expressions such as grunts, sighs, and moans, (3) and bodily movements such as guarding, holding, touching or rubbing. For the purposes of coding, the video record was divided into 12 10-s intervals (six intervals during water immersion, six intervals post-immersion). For each interval, coders determined the presence and duration of each category of pain behavior. Percentage agreement values for the classification of different pain behaviours were 80, 86, 76% for facial
expressions, paraverbal expressions, and bodily movements, respectively \((\kappa = 0.77)\). Discrepancies were resolved through discussion. Correlations between the two coders’ ratings of pain behaviour duration were 0.78, 0.82 and 0.78 for facial expressions, paraverbal expressions and bodily movements, respectively. For the purposes of the present study, only pain behaviour duration was analysed.

Coping. Following the cold pressor procedure, subjects were interviewed concerning the strategies they used to cope with the pain experience. The interview protocol was similar to that used in previous research on coping with cold pressor pain (Spanos et al., 1979; Sullivan et al., 1995, 2000). Interview records were transcribed and coded for coping content. Coping content was coded independently by two judges who were blind to experimental condition and level of catastrophizing. Responses were classified into one of four different categories: (1) distraction, (2) positive self-statements, (3) relaxation, and (4) re-interpreting sensations. Percentage agreement values between the two judges were 76, 80, 88, and 80% for distraction, positive self-statements, relaxation, and re-interpreting sensations, respectively \((\kappa = 0.79)\). For each participant, a composite coping score was obtained by summing the total number of coping strategies reported.

2.4. Procedure

Participants were told that the study was concerned with the relation between different thoughts and feelings and the experience of pain. The procedure was described to the participants and they were shown the cold pressor apparatus. Following signing of the consent form, participants were asked to place their non-dominant arm on the moveable armrest of the cold pressor apparatus and to lower their arm in the water. A recorded voice signalled the end of 1 min water immersion and asked participants to remove their arm from the water. They were signalled to provide verbal ratings of their pain at 20 s intervals during the water immersion and at 30 s intervals for the first minute post-immersion. Only one participant withdrew prior to completing the 1 min water immersion.

Half of the participants went through the cold pressor procedure alone in the testing room, and half went through the cold pressor procedure with an observer present. The observer (a research assistant) was dressed in a white lab coat and her ostensible purpose in the room was to record temperature readings from the cold pressor apparatus. The observer was instructed not to initiate interaction with the participant. She was instructed to briefly answer the first question posed by a participant. If a participant asked more than one question, the observer responded that she had to devote her attention to monitoring the water temperature.

3. Results

3.1. Pain Ratings

Pain ratings during the water immersion were analysed as a three-way mixed factorial with time (20, 40, 60 s) as the within groups factor and social context (participant alone, observer present) and level of catastrophizing (high, low) as between groups factors. Consistent with previous research, a three-way analysis of variance (ANOVA) revealed significant main effects for time, \(F(2, 120) = 83.5, P < 0.001\), and level of catastrophizing, \(F(1, 60) = 17.3, P < 0.001\). A significant time \(\times\) level of catastrophizing interaction was also obtained, \(F(2, 120) = 4.6, P < 0.01\). Tests of simple effects revealed that high catastrophizers rated their pain more intense than low catastrophizers at 20 and 40 s of the water immersion. Pain ratings provided at 60 s of the water immersion period did not vary significantly as a function of level of catastrophizing (Table 1).

A three-way ANOVA (time \(\times\) social context \(\times\) level of catastrophizing) was also performed on the pain ratings provided during the first minute following removal of the arm from the cold pressor. The results of this analysis revealed a main effect for time, \(F(2, 60) = 184.4, P < 0.001\), indicating that pain ratings decreased over the first minute post-immersion. Marginally significant main effects were also obtained for social context, \(F(1, 60) = 2.5, P = 0.12,\) and level of catastrophizing, \(F(1, 60) = 2.3, P = 0.13,\) as well as a significant three-way interaction, \(F(1, 60) = 3.5, P < 0.05\). Tests of simple effects revealed that in the condition where the observer was present, high

<table>
<thead>
<tr>
<th>Time of rating</th>
<th>20 s</th>
<th>40 s</th>
<th>60 s</th>
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</thead>
<tbody>
<tr>
<td><strong>During water immersion</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Participant alone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low catastrophizer</td>
<td>4.7 (1.2)</td>
<td>6.1 (1.6)</td>
<td>7.5 (1.2)</td>
</tr>
<tr>
<td>High catastrophizer</td>
<td>6.7 (2.1)</td>
<td>7.8 (1.6)</td>
<td>8.5 (1.2)</td>
</tr>
<tr>
<td>Observer present</td>
<td></td>
<td></td>
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<tr>
<td>Low catastrophizer</td>
<td>5.3 (1.6)</td>
<td>6.6 (1.0)</td>
<td>7.8 (1.2)</td>
</tr>
<tr>
<td>High catastrophizer</td>
<td>6.8 (1.9)</td>
<td>7.9 (1.5)</td>
<td>8.3 (1.5)</td>
</tr>
<tr>
<td><strong>After water immersion</strong></td>
<td></td>
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<tr>
<td>Participant alone</td>
<td></td>
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</tr>
<tr>
<td>Low catastrophizer</td>
<td>4.5 (1.8)</td>
<td>2.9 (2.5)</td>
<td></td>
</tr>
<tr>
<td>High catastrophizer</td>
<td>5.2 (2.1)</td>
<td>3.0 (2.3)</td>
<td></td>
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<tr>
<td>Observer present</td>
<td></td>
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<tr>
<td>Low catastrophizer</td>
<td>3.8 (2.1)</td>
<td>1.0 (1.1)</td>
<td></td>
</tr>
<tr>
<td>High catastrophizer</td>
<td>4.8 (2.4)</td>
<td>2.6 (2.5)</td>
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</tbody>
</table>

Values in parentheses are standard deviations.
catastrophizers reported more intense pain at 60 s post-immersion than low catastrophizers.

3.2. Pain behaviour

A two-way (social context × level of catastrophizing) ANOVA on total duration of pain behaviour yielded only a significant main effect for level of catastrophizing, \( F(1,60) = 4.2, P < 0.05 \). The main effect for social context, \( F(1,60) = 1.8, \) ns, and the two-way interaction, \( F(1,60) = 1.1, \) ns, were not significant. As shown in Table 2, high catastrophizers displayed pain behaviour for a longer duration than low catastrophizers.

Follow up ANOVAs were performed separately for communicative pain behaviours (e.g. vocalizations, grimaces) and pain management behaviours (e.g. rubbing, touching). For pain management behaviours, a two-way ANOVA revealed no significant effects. Specifically, pain behaviour duration did not vary as a function of social context, \( F(1,60) = 0.43, \) ns, level of catastrophizing, \( F(1,60) = 1.7, \) ns, or the interaction between social context and level of catastrophizing, \( F(1,60) = 0.28, \) ns.

For communicative pain behaviours, a two-way (social context × level of catastrophizing) ANOVA revealed a main effect for social context, \( F(1,60) = 7.4, P < 0.01, \) and level of catastrophizing, \( F(1,60) = 9.0, P < 0.01. \) Main effects were qualified by a significant two-way interaction, \( F(1,60) = 4.7, P < 0.05. \) As shown in Table 2, high catastrophizers displayed communicative pain behaviours for a significantly longer duration in the condition where the observer was present compared to the condition where participants were alone. For low catastrophizers, the duration of communicative pain behaviours did not vary as a function of social context. The two-way interaction remained significant even when pain ratings were statistically controlled.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Pain behaviour duration as a function of social context and level of catastrophizing</th>
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<tbody>
<tr>
<td></td>
<td>Social context</td>
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<tr>
<td>Total pain behaviour</td>
<td>Low catastrophizers</td>
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<tr>
<td></td>
<td>High catastrophizers</td>
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<tr>
<td>Pain management behaviour</td>
<td>Low catastrophizers</td>
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<tr>
<td></td>
<td>High catastrophizers</td>
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<tr>
<td>Communicative behaviour</td>
<td>Low catastrophizers</td>
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<td></td>
<td>High catastrophizers</td>
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</tbody>
</table>

Values in parentheses are standard deviations.

3.3. Coping strategies

A two-way ANOVA (social context × level of catastrophizing) on the total number of coping strategies reported revealed no significant main effects for social context, \( F(1,60) = 0.15, \) ns, or level of catastrophizing, \( F(1,60) = 1.1, \) ns. However, a significant interaction was revealed between social context and level of catastrophizing, \( F(1,60) = 5.5, P < 0.01. \) Tests of simple effects revealed that in the condition where participants were alone, high \( (M = 1.3, SD = 1.1) \) and low \( (M = 1.6, SD = 1.0) \) catastrophizers reported a similar number of coping strategies, \( t(28) = 0.8, \) ns. However, in the condition where the observer was present, high catastrophizers \( (M = 0.9, SD = 0.9) \) reported significantly fewer coping strategies than low catastrophizers \( (M = 1.8, SD = 0.9), t(32) = 2.6, P < 0.01. \) The two-way interaction remained significant even when pain ratings were statistically controlled.

Correlational analyses were computed between pain behaviour duration and the number of coping strategies reported. Significant inverse correlations were obtained between the total number of coping strategies reported and total duration of pain behaviour \( (r = -0.30, P < 0.01), \) and duration of pain management behaviour \( (r = -0.26, P < 0.05). \) A marginally significant correlation was obtained between total number of coping strategies and duration of communicative pain behaviour \( (r = -0.22, P < 0.08). \) The correlations between total duration of pain behaviour, duration of pain management behaviour and total number of coping strategies remained significant even when controlling for pain intensity.

4. Discussion

This study provides preliminary support for a communal coping model of pain catastrophizing. Specifically, high catastrophizers displayed communicative pain behaviours for a longer duration when an observer was present compared to high catastrophizers who were alone during the pain procedure. For low catastrophizers, social context did not influence the duration of communicative pain behaviour.

There are several mechanisms that might underlie the social cueing effects for the pain behaviour of high catastrophizers. One possibility is that pain catastrophizers may be attempting to satisfy affiliative or dependency needs during periods of distress, and will preferentially use strategies that maximize the probability that social proximity will be achieved and maintained (i.e. communal coping goals). Expressive pain displays could also be used to induce others to alter their expectations, reduce the performance demands placed on the individual in pain or as a means of managing interpersonal conflict (Keefe et al., 1997; Romano et al., 1992; Schwartz et al., 1996). Alternately, as function of a history of social reinforcement
of pain behaviour, social presence might become a conditioned stimulus for pain behaviour in high catastrophizers (cf. Block et al., 1980; Giardino et al., 2003; Gil et al., 1987; Paulsen and Altmayer, 1995). These accounts are not incompatible but they differ with respect to the characterization of the high catastrophizer as a passive respondent to reinforcement contingencies or an active engineer of social geography during times of distress.

Previous research has shown that pain patients with solicitous partners are influenced by knowledge that they are being observed. Specifically, when patients with solicitous partners were told they were being observed by their spouse, they reported more severe pain, and displayed significantly more pain behaviour than when they were not being observed (Block et al., 1980). Paulsen and Altmayer (1995) reported that patients with supportive spouses displayed more pain behaviour during a physical examination when their spouse was present compared to when their spouse was absent. It is possible that excessive support or solicitousness may play a role in the development of a catastrophic orientation to painful situations.

Even though the communal and operant models make similar predictions concerning the influence of an observer, the implied processes are markedly different. In the operant model, the individual exhibits more pain behaviour in the presence of another person as a result of previous experience suggesting a higher probability of reinforcement. For the operant model, reinforcement could take many forms, including attention, sympathy or support. In the communal coping model, individuals behave in a manner that will maximize the probability that a stress situation will be managed within an interpersonal context. The two models are not independent since operant principles are expected to have at least some degree of influence on any type of overt behaviour. The models differ on questions concerning the ontology of exaggerated pain expression and the functions of pain expression. The communal model construes the expressive style of pain catastrophizers as an adaptational orientation; the operant model makes no such assumption. For the operant model, present pain behavior can be understood from knowledge of an individual’s reinforcement history. Given the limits of human behavioural research paradigms, the distinguishing features of these two models will be difficult to demonstrate in a compelling fashion.

However, there are grounds for suggesting that more than operant principles need to be invoked in order to explain the observed findings. Social presence influenced not only the display of pain behaviours, but also the report of coping strategies. Since coping strategies are not overt, it is more difficult to explain how they might be selectively reinforced (in the case of low catastrophizers) or punished (in the case of high catastrophizers) by social presence.

When an observer was present, high catastrophizers reported using significantly fewer cognitive pain coping strategies than low catastrophizers. It is possible that high catastrophizers may be less motivated to use strategies that will minimize their physical and emotional distress when an observer is present. It could be argued that strategies that minimize the experience of physical and emotional distress are at odds with communal coping goals of maintaining social proximity or maximizing support. In other words, if high catastrophizers have a preference for dealing with their distress within an interpersonal or relational context, any effort to minimize their distress will reduce the probability that their coping goals will be achieved.

It is also possible that high catastrophizers may choose expressive strategies for dealing with pain as a result of their ineffective use of pain coping strategies. Spanos et al. (1979) suggested that high catastrophizers’ propensity to focus on pain sensations may interfere with the effectiveness of pain coping strategies. Consistent with this view, a number of investigations have provided data suggesting that pain coping strategies may be less effective when used by high catastrophizers (Spanos et al., 1979; Heyneman et al., 1990; Sullivan et al., 1995). A number of investigations have also shown that catastrophizing is associated with lowered confidence in the ability to effectively use pain coping strategies (Beckham et al., 1991; Keefe et al., 1987; Rosenstiel and Keefe, 1983). Strategies used to maximize the proximity of others may be motivated, at least in part, by low levels of coping efficacy.

It is interesting to note that social cueing effects were obtained for pain behaviours and not for pain ratings. Although pain ratings can be construed as a form of pain behaviour, different processes are involved in producing pain ratings and pain behaviours. First, pain ratings are not a natural form of expression for the experience of pain. The conversion of a sensation into a numerical value is a demand of the experimental situation and is rarely observed in everyday communication of pain experience. In order to provide a pain rating, the individual must reflect on current pain experience, compare the experience to the type of sensation represented by scale anchors, and consciously produce a report. The display of pain behaviour does not require conscious reflection on experience, or the conversion of experience to a value defined in relation to specific endpoints on a continuum. Furthermore, pain ratings in an experimental setting are typically emitted in response to a signal or request while pain behaviours are spontaneously emitted. These differences in response-related processes may explain why social context effects were observed on pain behaviours and not pain ratings.

Several investigations have highlighted the potential maladaptive outcomes associated with catastrophizing (Keefe et al., 1989; Turk, 2002; Turk et al., 1983). As noted earlier, considerable research has shown that catastrophizing contributes to heightened physical and emotional distress (Sullivan et al., 2001). It has been suggested that in the pursuit of communal coping goals, catastrophizers may inadvertently make their pain experience more aversive. For example, it has been shown that
the exaggerated display of pain behaviour can contribute to heightened pain experience (Craig and Prkachin, 1978).

Although the coping style of high catastrophizers may appear maladaptive, it is important to consider that a communal coping style may only become truly maladaptive under chronic pain or chronic illness conditions. In response to acute pain, exaggerated pain displays may result in a precarious, but sustainable, balance between satisfying support or affiliative needs, and increasing pain-related distress. Under acute pain conditions, overall benefits may outweigh costs, and reinforcement contingencies (e.g. increased support, attention, empathic responses) may actually serve to maintain the expressive style of high catastrophizers. When conditions become chronic, this balance may be disrupted such that costs begin to outweigh benefits. Social environmental responses may become increasingly negative when distress displays extend over a period of time. The disrupted balance may find expression as increased interpersonal conflict, social rejection and depression. The present findings suggest that a closer examination of the social contextual variables related to pain experience may clarify the basis of many of the negative outcomes associated with catastrophizing.

Some degree of caution must be exercised in the interpretation of the finding of the present study. The generalizability of findings is limited by the use of a student sample participating in an experimental pain procedure. The experimental setting is devoid of the complex array of social and environmental stimuli and contingencies under which pain is typically experienced. In addition, experimental pain paradigms are not associated with the same degree of threat that typically accompanies the pain of injury or illness. These factors that necessarily compromise the ecological validity of the findings.

In summary, the present research provides preliminary evidence that the relation between catastrophizing and the expressive dimensions of pain experience are influenced by social context. Experimental manipulation of social context influenced both the display of pain behaviour and the use of cognitive coping strategies. The findings also highlight that exclusively intrapsychic conceptualizations of pain catastrophizing as a maladaptive cognition are incomplete. A full understanding of the functions and consequences of pain catastrophizing will require more attention to questions concerning communication goals, coping preference and coping efficacy, interpersonal needs, and the social reinforcement contingencies that influence how, and to whom pain will be expressed.

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References


