

In-group reassurance in a pain setting produces lower levels of physiological arousal: Direct support for a self-categorization analysis of social influence[†]

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Abstract

A large body of research demonstrates a strong social component to people's pain experiences and pain-related behaviours. We investigate this by examining the impact of social-influence processes on laboratory-induced pain responses by manipulating the social-categorical relationship between the person experiencing pain and another who offers reassurance. We show that physiological arousal associated with laboratory-induced pain is significantly lower in normal, healthy participants following reassurance about the pain-inducing activity when that reassurance comes from an in-group member in contrast to reassurance from an out-group member and a no reassurance control. These data are consistent with predictions derived from self-categorization theory, providing convincing empirical support of its analysis of social influence using a non-reactive measure. These data also represent a clear advance within the pain literature by identifying a possible common process to the social-psychological component of pain responses. Copyright © 2006 John Wiley & Sons, Ltd.

The experience of pain is both subjective and personal (Anand & Craig, 1996). To recognize this, however, does not imply the absence of social-psychological processes that may underlie this experience and any subsequent expression of it. Indeed, a large and varied body of research now demonstrates a strong social component associated with, if not causally affecting, people's pain responses, including their verbal reports of pain experiences, physiological responses (e.g. galvanic skin response; GSR), as well as other pain-related behaviours (e.g. tolerance). In this manner, just as

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psychologists now recognize the inadequacy, if not inaccuracy, of purely intrapsychic, individualistic explanations of other behavioural phenomena (e.g. stereotyping, leadership), so too have they recognized the important contribution of social processes to the experience and behavioural expression of pain.

In the current paper, we first present a brief overview of the empirical literature demonstrating the presence of a social component underlying people's pain responses. We then present a more focussed review of the empirical literature suggesting that group processes constitute at least part of the social-psychological contribution to these responses. Finally, we propose and test a more formal theoretical explanation, based upon self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987), for both the empirical presence and *apparent absence* of social effects on pain responses under specific conditions.

THE SOCIAL-PSYCHOLOGICAL CONTRIBUTION TO PAIN RESPONSES

At least three independent empirical domains demonstrate a social-psychological contribution to pain responses. First, cultural and ethnic differences obtain in both pain expression and tolerance (e.g. Green et al., 2003). Among chronic pain sufferers, for example, differences in overall pain-severity reporting have been observed between various American ethnic groups (Bates, Edwards, & Anderson, 1993). In comparisons specifically between European Americans and African Americans, differences obtain in pain-descriptor usage (Cassisi et al., 2004), and emotional responses and pain-related behaviours (e.g. 'reduction in family-related responsibilities', Riley et al., 2002, p. 293). Cultural and ethnic differences also obtain with more acute pain experiences in both laboratory (e.g. through the use of a cold-pressor task; Nayak, Shiflett, Eshun, & Levine, 2000) and clinical settings (e.g. post-operative pain; Ng, Dimsdale, Shragg, & Deutsch, 1996).

Second, and potentially offering an explanation for at least some of the above cultural differences, social modelling directly affects individuals' pain responses. In family settings, for example, Edwards, Zeichner, Kuczmierczyk, and Boczkowski (1985) found a positive correlation between self-reports of pain frequency and the number of family members also experiencing pain. In more controlled laboratory settings using an experimental electric shock paradigm, research participants exhibit lower levels of physiological arousal (Craig & Prkachin, 1978) and lower levels of self-reported pain (Craig, 1978) upon observing tolerant compared to intolerant models. Greater pain tolerance also follows the observance of tolerant than intolerant models using an experimental cold-pressor task (Thelen & Fry, 1981), a finger-pressure task (Turkat & Guise, 1983), and following isometric exercise (Symbaluk, Heth, Cameron, & Pierce, 1997).

Finally, direct verbal communications also affect pain responses. A meta-analysis of various forms of clinical pain (e.g. headache, post-operative pain, acute back pain), for example, revealed a reliable decrease in reported pain intensity following analgesic placebo 'suggestion' (Vase, Riley, & Price, 2002, p. 444). In laboratory contexts, tolerance levels to electric shock increase when participants are: (a) provided with a description of the shock apparatus and common responses of others (Staub & Kellett, 1972), (b) simply told to be 'tough' (Wolff & Horland, 1967, p. 404) and (c) informed that music will inhibit pain (and they actually hear the music; Lavine, Buschbaum, & Poncy, 1976). Similarly, with thermal pain, tolerance increases when participants are told that they *should* be able to endure the painful (heat) stimuli (Clark & Goodman, 1974), and when they are told that the painful (cold) stimuli has beneficial health effects (Staats, Hekmat, & Staats, 1998).

Collectively, these three broad, and often independent, research areas unequivocally implicate social-psychological processes as significantly (both statistically and substantively) playing causal

roles in pain-related responses, be they verbal, behavioural or physiological. What they collectively lack, however, is the recognition that there may be a common process underlying all of them beyond, simply, 'social-psychological factors'. We are not suggesting that independent processes may also contribute uniquely to each domain; undoubtedly, they do. However, we are suggesting that identification of one or more common processes would help clarify and integrate these three (if not other) areas. Moreover, we believe that the extant empirical pain literature already points to a common process, one associated with *salient psychological group memberships*.

THE EMPIRICAL ROLE OF SALIENT PSYCHOLOGICAL GROUP MEMBERSHIPS IN PAIN RESPONSES

A small body of empirical work suggests an important role of salient group memberships in determining a variety of pain responses. For example, in a laboratory social-modelling study, Chaves and Barber (1974) found that the modelling was 'largely ineffective' (p. 361) in altering judgments of administered finger-pressure pain. In explaining their findings, the authors suggested that the intergroup nature of the modelling in their study may have led to their null effects, in which there were female participants but male models. Intragroup processes have also been implicated in pain responses, particularly in placebo success. Turner, Deyo, Loeser, von Korff, and Fordyce (1994), for example, identified several factors moderating the success of placebos, including the social-psychological factors of the provider's 'warmth, friendliness, interest, sympathy, prestige, and positive attitude towards the patient' (p. 1611). For our purposes, we note that many of these factors are *outcomes* of shared group membership (e.g. Turner et al., 1987). And when studying social exclusion from a group, Eisenberger, Lieberman, and Williams (2003) observed heightened activity in the anterior cingulate cortex, a brain region associated with the experience of physical pain.

At least three experiments provide more systematic analyses of the effects of group membership on pain responses. Strassberg and Klinger (1972) observed an interaction on shock-pain tolerance between a supposed tolerance norm within participants' laboratory groups, the experimenter's direct verbal communication about the task and participants' sex. Among males, the data suggested a tolerance ceiling effect across conditions; among females, however, tolerance levels were enhanced by tolerant group norms in two of three experimenter-communication conditions. Using pre-existing groups, Lambert, Libman, and Poser (1960) presented supposed pressure-pain tolerance group norms to Christian and Jewish participants. Christians increased their tolerance *both* when they believed their group could 'take more' and 'take less' (p. 355) pain than Jews; Jews increased their tolerance only when they believed their group could take less pain than Christians. Finally, Buss and Portnoy (1967) showed not only increased shock-pain tolerance when own-group tolerance norms were supposedly lower than a contrast group's norms, but that this tolerance increased with the increasing levels of identification participants had with their group.

From this research, at least two different group-based processes appear to affect the variability in pain responses. One process is that of intergroup social competition (Tajfel & Turner, 1986), whereby people are motivated, under certain circumstances, to differentiate positively their in-group from relevant out-groups. This is suggested in the work of Lambert et al. (1960), and especially by Buss and Portnoy (1967). The second process is in-group social influence (Turner, 1991), whereby people's subjective understanding of reality (both physical and social) is determined, in part, by their understanding of in-group, but not out-group norms. Conformity to in-group norms observed by Lambert et al. and Strassberg and Klinger (1972) are examples of this. So too is the suggested resistance to out-group modelling observed by Chaves and Barber (1974), and the necessity of effectively creating

an in-group feeling for placebo success suggested by Turner et al. (1994). It is this second process of in-group social influence that we next consider in more detail below, framing our analysis within the parameters of self-categorization theory.

SELF-CATEGORIZATION THEORY, SOCIAL INFLUENCE AND APPRAISAL OF STRESSFUL SITUATIONS

Self-categorization theory is a theory of intragroup processes, intergroup processes and the self (Turner et al., 1987). Among other things, the theory has been applied successfully to analyses of a variety of health-related behaviours, including smoking (Schofield, Pattison, Hill, & Borland, 2001), safe sex (White, Terry, & Hogg, 1994), assessments of AIDS risks (Campbell & Steward, 1992), and appraisals of normal (Hardie & Mc Murray, 1992) and illness-related health conditions (Levine, 1999; Levine & Reicher, 1996). One area of research that has received a great deal of attention within self-categorization theory is that of social influence (Turner, 1991). The theory proposes that it is by in-group members, not out-group members, that we are influenced. It is in-group members whom we trust and believe to hold meaningful and veridical views of the world. Within this framework, the distinction between supposed normative and informational influence (e.g. Deutsch & Gerard, 1955) 'is replaced by the idea that the basic influence process is one where the normative position of people categorized as similar to self tends to be subjectively accepted as valid' (Turner, 1991, p. 171).

Successful empirical demonstrations of in-group social influence have been observed in a variety of domains. For example, Abrams, Wetherell, Cochrane, Hogg, and Turner (1990) successfully replicated and extended the classic line-conformity study of Asch (1956), showing conformity to in-group but not out-group members. Bond and Smith (1996) confirmed this in a meta-analysis of 103 separate studies using the same or similar Asch paradigms. In-group, but not out-group, social influence has also been observed on a variety of attitudinal issues (e.g. McGarty, Haslam, Hutchinson, & Turner, 1994), artistic judgments (Platow, Mills, & Morrison, 2000), in-group polarization (Mackie, 1986), contagious laughter (Platow et al., 2005) and, importantly, in appraisals of stressful situations (Haslam, Jetten, O'Brien, & Jacobs, 2004).

This final situation is particularly relevant to the current issue of pain because it specifically examines the effects of in-group and out-group social-influence attempts in affecting subjective health-related experiences. In their study, Haslam et al. (2004) presented participants with a communication that described a potentially stressful situation as either stressful or challenging. This communication was said to have come from either an in-group member or an out-group member. After actually experiencing the stressful situation (a mental arithmetic task), participants provided self-report ratings of their stress levels. Consistent with the self-categorization analysis of social influence, participants' reported stress levels were lower following an in-group stress communication than an in-group challenging communication; but such a difference did *not* obtain following the identical communications from an out-group member.

THE CURRENT EXPERIMENT

In the current research, we sought to understand role of group-based social influence on pain responses. The *empirical* rationale for our work stems from both the broad observation of social-psychological variables affecting pain responses in a variety of pain-related contexts, as well as the specific

observation of group-related processes underlying many of these effects. The *theoretical* rationale stems from the analysis of social influence provided by self-categorization theory, and the crucial notion that veridical accounts of reality, including our own subjective experiences of this reality, follow in part from communication from in-group but not out-group members. In the context of laboratory-induced pain, we predicted that direct verbal communications about a pain experience would affect pain responses relative to a no-communication control when delivered by a fellow in-group member but not an out-group member. We examined two types of pain responses, tolerance and physiological arousal (measured via GSR). In addition, we measured participants' levels of social identification with the experimentally relevant in-group. Previous work (e.g. Buss & Portnoy, 1967) suggests that identification levels may moderate our current manipulation, with in-group influence obtaining primarily, if not solely, among high identifiers.

METHOD

Overview

University science students participated in a cold-pressor task. After initial base-line experience with the task, either an in-group member (same university degree) or an out-group member (different university degree), both of whom supposedly participated previously in the experiment, offered reassurance about a second trial. In a third, control condition, there was no reassurance. We expected that only reassurance from an in-group member would lead to relatively greater tolerance and lower GSR levels on the second trial (controlling for base-line tolerance and GSR, respectively).

Participants and Ethics

Thirty-two male and 22 female undergraduate students, enrolled in courses in the La Trobe University Faculty of Science, Technology and Engineering (FSTE), voluntarily participated by responding to advertisements posted around campus. Although naïve to the experimental aims and hypothesis, all participants knew the experiment involved pain. Before the conduct of the actual experiment, participants completed a pre-screening questionnaire asking whether they were currently using any medicinal or recreational drugs, and whether they had any known medical or psychological problems. Only fully healthy participants not taking any drugs (including, importantly, analgesics) were allowed to continue.¹ All participants were paid AUD\$20. Ages ranged from 18 to 35 years (median = 20 years).

Ethical permission to conduct this research was granted by the La Trobe University FSTE Human Ethics Committee (FHEC02/R48). As part of the ethical procedures agreed to with this Committee, initial recruitment advertisements began with the statements, 'Participants wanted for a study of pain and attitudes. Healthy participants between the ages of 18 and 55 years are required to participate in a

¹Questions asked participants whether they: (1) would currently describe themselves in 'good health'; (2) had ever suffered from or been treated for hypertension, any kind of heart condition, any form of epilepsy, any anxiety or phobic conditions, depression, menstrual problems or other hormonal disorders, any kind of persisting or chronic pain, and any kind of circulatory/vascular disorder; (3) were suffering from any other illness, disease or medical problem, (4) currently had any pain anywhere in their body, (5) normally take or are currently taking any prescription or over-the-counter medications, (6) had taken *any* drugs in the past 72 hours and (7) were currently (or possibly) pregnant. No participant indicating any type of illness, the taking of any drug, or pregnancy was allowed to participate.

research project investigating the nature of student beliefs and pain tolerance', and that participation would involve 'exposure to a brief pain tolerance test'. A signed Statement of Informed Consent was also completed before any participant was allowed to continue with the experiment. This Statement described the 'aim of the study' as the investigation of 'the nature of pain tolerance', and that participants would 'undergo two trials of pain tolerance', would have their 'skin conductance (a stress measure) monitored', and that 'temporary pain and discomfort [would] be experienced but the procedure [was] very safe, with virtually no risk of harm'. Following normal ethical guidelines, participants were also told that they were free to withdraw from the study at any time. Finally, we note that the \$20 payment to each participant was also part of the ethical agreement with the Committee 'as partial compensation for [participants'] inconvenience'.

Materials and Procedure

Each participant completed the experiment individually. Upon arrival at the laboratory, the experimenter verbally reminded each participant that the study was an investigation of pain, and asked him or her to read an informed consent form (all participants consented).

Galvanic skin response monitors were then placed on two fingers of each participant's dominant hand. On the experimenter's instruction, the participant then immersed his or her non-dominant hand up to the wrist into a bath of ice water (0–2°C), and kept it there until he or she could no longer tolerate the pain. The duration of immersion was recorded by the experimenter with a digital stopwatch. Ethical requirements led us to instruct participants to remove their hands after 130 seconds. GSR was measured continually for the first 100 seconds of immersion, or until participants removed their hand from the water.

Following completion of this trial, participants completed a six-item social identification questionnaire (SIQ) based on Mael and Ashforth (1992); the questionnaire was modified to be appropriate to the group 'science students'. Example items are, 'When I talk about science students, I say "we" rather than "they"', and 'When someone criticizes science students, it feels like a personal insult' (1 = 'do not agree at all'; 10 = 'agree completely').

During completion of the SIQ, the experimenter left the laboratory under the pretext of getting more paper towels for the participant to dry his or her hand for the second trial. During the experimenter's absence, a confederate entered for the two treatment conditions. In both conditions, the confederate acted (to a pre-established script) as a previous participant in the study who had accidentally failed to return a questionnaire to the experimenter, and was now coming back to hand in the questionnaire. All actual questionnaires were printed on green paper. In the in-group condition, the confederate's questionnaire was also green; in the out-group condition, the confederate's questionnaire was yellow. After asking if the experimenter was present, the confederate said to the participant:

I accidentally took this form with me before and thought I better bring it back. Now where's the box [into which to place the questionnaire]? Um, Science [Arts] box; there we go. Your paper's green, you must be from Science. I'm from Science, too [Arts]. Have you started yet?

After the actual participants replied that they had completed only the first trial, confederates in both conditions offered the reassurance (as the social-influence attempt), 'Well, don't worry, the second time's much easier'. The confederate then left, and the experimenter returned. The absence of the experimenter during the confederate's conversation with each participant ensured that the experimenter was blind to the experimental condition. In the control condition, participants were seated in the laboratory by themselves for same duration of time; these participants received no reassurance about the second trial.

The second trial proceeded in an identical manner to the first. After completion of the second trial, participants in the treatment conditions responded to a manipulation check questionnaire in which they were asked if they had met any other participants from the study and, if so, what that person's university degree was. In both the in-group condition and the out-group condition, 13 out of 18 participants correctly indicated the confederate's degree. Because of the equal proportions of correct to incorrect responses in both conditions, as well as the relatively low overall cell sizes, we decided to retain all participants for the analyses as conservative tests of our hypotheses.

Upon completion, all participants were fully debriefed.

RESULTS²

Social Identification

The six items measuring social identification with the group 'science students' formed a reliable scale ($\alpha = 0.82$), and, hence, the average response across the six items for each participant was calculated. The average social identification level in the sample was 5.25 ($SEM = 0.24$), and there was no statistically significant difference in level of social identification between the three manipulated conditions, $F(2, 51) = 1.83, p > 0.05$. We next identified relatively high and low identifiers via a median split. High social identifiers had higher social identity with the group 'science students' ($M = 6.69, SEM = 0.25$) than low social identifiers ($M = 3.80, SEM = 0.23$), $t(52) = 10.34, p < 0.001$. We treated this new categorical level-of-social-identification variable as an additional predictor in our analyses below.

Pain Tolerance

Twenty-eight participants (51.9%) during the first trial and 25 participants (46.3%) during the second trial kept their hand immersed for the entire 130-second ethical limit. This high percentage of participants tolerating the pain to the ethical maximum greatly reduced variability, leaving little room for tolerance levels to increase between the two trials. Nevertheless, we conducted a 3 (in-group influence; out-group influence; control) $\times$ 2 (high social identity; low social identity) between participants analysis of covariance (ANCOVA) on the duration of second-trial hand immersion, with the first-trial duration as a covariate. Only the covariate was significant, $F(1, 47) = 138.16, p < 0.001, \beta = 0.87$, partial $\eta^2 = 0.75$. The average duration time in the entire sample was 91.53 seconds ($SEM = 0.77$). A 3 $\times$ 2 multinomial logistic regression predicting tolerance-change categories (increase, decrease, no change) also yielded no significant treatment effects.

Galvanic Skin Response

A 3 $\times$ 2 between participants ANCOVA was conducted on the second-trial average GSR, with first-trial average GSR as a covariate. As would be expected, trial-one GSR significantly predicted trial-two

²Initial analyses including sex as a predictor revealed only a sex main effect for tolerance ($F(1, 42) = 6.67, p < 0.05$, partial $\eta^2 = 0.14$), indicating that males were more pain tolerant ($M = 100.30$ s, $SEM = 4.32$) than females ($M = 82.87$ s, $SEM = 5.05$) (cf., Nayak et al., 2000). The analyses we report below exclude sex as a factor.

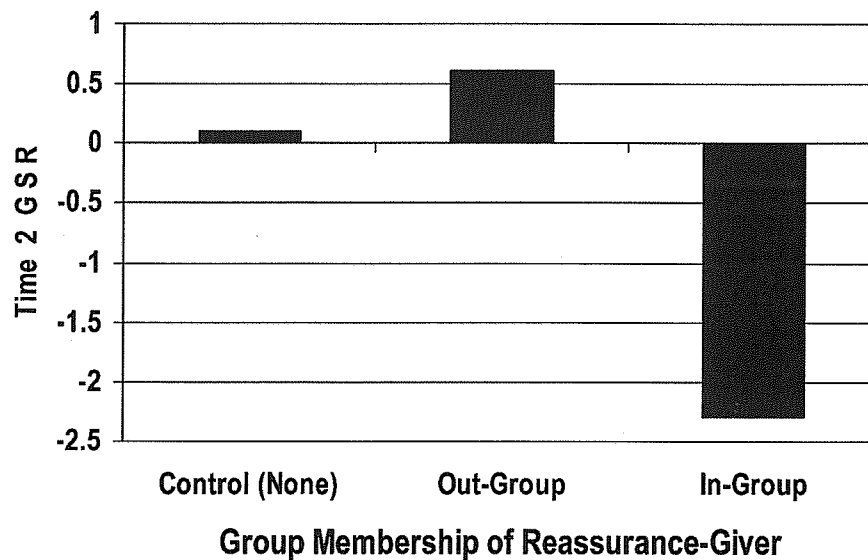


Figure 1. Statistically significant influence-condition main effect showing that trial-two physiological arousal was lower among participants in the in-group condition than either the out-group condition or the control condition

GSR, $F(1, 47) = 15.12$, $p < 0.001$, $\beta = 0.46$, partial $\eta^2 = 0.24$. More importantly, the influence condition main effect was significant, $F(2, 47) = 3.25$, $p < 0.05$, partial $\eta^2 = 0.12$. Planned contrasts of the adjusted means (see Figure 1) showed that trial-two physiological arousal was significantly lower among participants in the in-group condition ($M = -2.30$ microseimens, $SEM = 0.86$) than either the out-group ($M = 0.64$ microseimens, $SEM = 0.90$; $t(34) = 2.36$, $p < 0.05$, one-tailed) or the control condition ($M = 0.10$ microseimens, $SEM = 0.82$; $t(34) = 2.02$, $p < 0.05$, one-tailed). Although the average GSR level in the out-group condition was slightly *higher* than in the control condition, this difference was not statistically significant ($t(34) = 0.45$). The social identification main effect was marginally significant ($F(1, 47) = 3.68$, $p = 0.06$, partial $\eta^2 = 0.07$), indicating lower physiological arousal among high identifiers ($M = -1.47$ microseimens, $SEM = 0.70$) than low identifiers ($M = 0.43$ microseimens, $SEM = 0.71$). The interaction was non-significant, $F(1, 47) = 1.20$, $p = 0.31$, partial $\eta^2 = 0.05$.³

Despite this non-significant interaction between our communication conditions and participants' levels of social identification, we explored the simple effects for the GSR data. Level of social identification was unrelated to GSR in both the out-group communication ($F(1, 15) = 0.22$) and control conditions ($F(1, 15) = 0.01$). By contrast, however, a significant level of social identification effect obtained on the in-group communication condition, $F(1, 15) = 4.96$, $p < 0.05$, partial $\eta^2 = 0.25$. Consistent with expectations, physiological arousal was, indeed, lower among high identifiers ($M = -4.26$ microseimens, $SEM = 1.43$) than low identifiers ($M = -0.34$ microseimens, $SEM = 1.01$). Although we do not want to overstate this finding, it appears that the participants who were particularly

³We conducted separate ANCOVAs of both of our dependent variables treating social identification as a three-level variable (high, medium and low) as well as a continuous variable. No significant differences emerged in the tolerance data. For GSR, treating social identification as a three-level variable again yielded a significant influence-condition main effect ($p < 0.05$), a marginally significant identification main effect ($p = 0.06$) and a non-significant interaction ($p = 0.16$). Treating social identification continuously yielded a non-significant identification main effect ($p = 0.10$) and a non-significant interaction ($p = 0.49$); the social influence main effect was marginally significant ($p = 0.07$). Planned contrasts of the adjusted means of this latter analysis, however, still demonstrated lower physiological arousal among participants in the in-group condition than either the out-group condition ($p < 0.05$, one-tailed) or the control condition ($p < 0.05$, one-tailed).

receptive to the in-group reassurance were those for whom the group was particularly important—wholly consistent with our theoretical analysis.

DISCUSSION

The results of this study support our primary hypothesis, at least with regard to physiological arousal. Participants' GSR levels were influenced by direct verbal communications from in-group but not out-group members. Tolerance levels, by contrast, were not reliably affected by our manipulated variable, most likely due to ceiling effects; unlike some previous cold-pressor research that excluded participants who reached ethical limits (e.g. Staats, et al., 1998; Thelen & Fry, 1981), we retained all in our analyses. Having noted this non-significant tolerance finding, however, our GSR data are even more striking because we have a context in which participants did not differ significantly in their physical contact with the pain stimulus, and yet differed significantly in their physiological arousal in a manner consistent with predictions. Overall, these results have important implications in at least two relevant domains.

The first domain for which our data have relevance is the pain literature itself. We introduced our paper with a review and integration of the research demonstrating an unequivocal social-psychological component to a variety of pain-related responses (including verbal, behavioural and physiological) across a variety of pain domains (acute laboratory, acute clinical and chronic). The three broad areas of research that we reviewed—those reporting cultural and ethnic differences, social modelling and verbal communication such as placebo instructions—often exist independently of each other, most likely because of their different theoretical and applied foci. Nevertheless, they have the ability to inform each other, and research and theory pursuing an understanding of common mechanisms will represent an advance. We believe that the self-categorization social-influence analysis that we have currently presented outlines one such common mechanism.

For example, cultural and ethnic group differences in pain responses are likely to derive from salient in-group norms, transmitted through in-group communication. Cross-cultural and cross-ethnic pain-related communications are less likely to influence pain responses, *at least when these social categories are psychologically salient and contextually relevant*. In terms of social modelling, the implications are also clear. Although the literature is quite consistent in showing that people are influenced by others in terms of the pain responses, the social-modelling research strategies to date have implicitly assumed that all models are roughly equivalent. However, anomalies in this literature (e.g. Chaves & Barber, 1974) have pointed to the role of salient group memberships in setting boundary conditions to the scope of possible influence. The present research suggests that successful influence is most likely to obtain from salient in-group models rather than out-group models. Finally, our research suggests that the relative success of verbal communications, such as placebo communications, is also likely to obtain primarily if not solely when administered from in-group members. Taken together, our research suggests the common parameter of in-group social influence as underlying at least part of the social-psychological components to pain responses reported in each of these three literatures, while pointing to the important role of in-group social support in responses to pain (cf., Haslam, O'Brien, Jetten, Vormedal, & Penna, 2005).

The second domain for which our data have relevance is that of self-categorization theory. Although the empirical case for in-group social influence is strong, the research to date has focussed on relatively reactive measures of influence, such as self-report ratings and public conformity. Unfortunately, this leaves scope for critics to levy arguments against self-categorization theory's claim that in-group social influence represents true influence (i.e. internalization) rather than mere conformity. Although GSR

responses *can* be consciously controlled, we believe that this measure remains *substantially* less reactive than previous measures used in the self-categorization social-influence literature. In that manner, we have relatively strong evidence in support for self-categorization theory's claim that social influence does, indeed, obtain primarily if not solely from in-group members. To our knowledge, these are the strongest data published to date in support of this analysis.

Although we see strength in our findings, it is worth considering potential weaknesses in the experiment. First, readers may see the results to be limited by the absence of predicted differences in actual tolerance. As noted above, we see this largely as a problem of ceiling effects imposed by ethical restrictions. However, taking these data at face value, they are likely to highlight the importance of the actual communication. Recall that the confederate in our study did *not* express an analgesic attitude (e.g. 'the second trial does not hurt as much'), but one simply of task ease. This may account for an enhancement of physiological calmness in the absence of concomitant enhanced pain-tolerance. Indeed, in Haslam et al.'s (2004) study, different stress-related communications yielded different outcomes, at least when these communications were from in-group members. This clearly points to the need to study further the potential differential effects of the nature of the communication on different forms of pain responses.

Second, readers may also see the results to be limited by the overall sample size. Notwithstanding our difficulty in recruiting participants for a study explicitly on pain, we see the very fact that we obtained a pattern of statistically significant differences consistent with our theoretical predictions as very strong support for our analysis. Indeed, a critique of our study reveals not simply a relatively small sample size, but social categories unassociated with pain (e.g. we did *not* use 'pain sufferers' as the relevant category; cf., Haslam et al., 2004), a context in which *all* participants heard the exact same reassuring communication from another research participant who experienced the identical pain-inducing procedure, and the use of a non-reactive measure. Viewed in this light, the data can be seen as quite convincing, especially since there was no *theoretical* analysis in the extant pain literature that would have predicted this pattern.

In conclusion, we note how we began this paper, by observing a clear social-psychological component to pain responses. We also observed, however, that, although unequivocal, the patterns of responses remain variable in a manner consistent with psychological group processes. We sought to explain this variability, and to outline one possible common process underlying pain responses observed in three broad domains of research; this process was one of in-group social influence, as delineated by self-categorization theory. In testing hypotheses derived from this theory, we were able to confirm at least one component of our predictions within established ethical requirements. We see our data as representing a clear advance in both the pain literature, in identifying a possible common process to the social-psychological component of pain responses, and within self-categorization theory itself, in providing the convincing empirical support using a non-reactive measure.

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