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Inducing bias modulates sensitivity to nonverbal cues of others' pain

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Abstract

Background: There is ample research to support the existence of bias in the perception of others' pain. Both studies involving health-care professionals and student surrogate samples have found that, firstly, pain is under-perceived when using nonverbal cues to gauge another's suffering and, secondly, that personal characteristics of both the viewer and the target (such as gender) can bias pain perception, affecting the allocation of help. However, the extant research shows conflicts about the direction of the bias that target gender exerts on pain perception. Our study aims to address these challenges by examining whether under-perception of pain can be attenuated or exacerbated with gender primes and how target gender affects nonverbal pain perception, in particular.
Methods: University students ($N = 120$) were primed with either masculine, neutral, or feminine concepts followed by photos of male and female targets displaying various levels of pain and asked to quantify the photographed targets' distress.
Results: Participants perceived lower target distress when this task was preceded by a masculine gender prime, as compared to a neutral or feminine gender prime. Pain was underestimated for all targets; however, this underestimation was significantly more pronounced for female targets.
Conclusions: These results suggest that gender cues may influence the perception of observed pain and, as a result, clinical decision making. They also support the conjecture that nonverbal pain cues may be under-perceived in women.

1. Introduction

Pain is one of the most common and disabling symptoms that patients experience (Coté et al., 1998; Guereje et al., 1998; Elliot et al., 1999). Being able to control pain through medical intervention is therefore essential both for maintaining a patient's quality of life and for guaranteeing satisfaction with the health care being received (Hanna et al., 2012). Many patients do not experience adequate pain management; however, up to 17% of inpatients are not fully satisfied with the quality of pain management that their health-care teams provide, and this percentage increases in groups who find it hard to communicate their pain needs, such as children (Gill et al., 2013), patients with dementia (Fuchs-Lacelle, 2008), and non-anglophones in anglophone hospitals (Jimenez et al., 2012). Patients with impaired communication may be at particular risk of under-treatment, as health-care practitioners have been shown to not perform well in recognizing pain from nonverbal cues (Kappesser and Williams, 2002).

The goal of the present study was to test a proposed method of counteracting the tendency to underestimate the pain of others by increasing sensitivity to nonverbal cues of pain via priming thoughts related to

What's already known about this topic?
- Pain is under-perceived when using nonverbal cues to gauge another's suffering.
- Personal characteristics of both the viewer and the target can bias pain perception.

What does this study add?
- Priming masculine thinking reduces sensitivity to observed pain.
- The under-perception of other's pain depends on the gender of the person in pain: women's pain is perceived more inaccurately than men's pain.

gender. Femininity is associated with empathic and nurturing behaviour (Hoffman, 1977; Eagly and Steffen, 1984), which typically presumes care for, and sympathy with, others. This, in turn, requires attending to distress cues from others in order to recognize the need for care. As women have been found to be more interpersonally sensitive than men (Hall, 1984; Hall and Schmid Mast, 2008), reminding participants of times that they behaved in stereotypically feminine ways (e.g., relied upon others for help) may prime femininity and associated behaviours (Deaux and Major, 1987) – such as heightened attention to nonverbal cues. Masculine primes would predictably have the reverse effect on sensitivity to nonverbal cues. Both primes were therefore predicted to produce changes in participants' perceptions of another person's pain and another's need for help. Thus, the primary hypothesis was that femininity primes would increase perceptions of targets' distress, whereas masculinity primes would decrease perceptions of targets' distress. To test this, we used gender role primes previously shown to influence self-reports of pain (Fowler et al., 2011).

A secondary objective of the study was to account for target gender in others' pain perception. Both health-care professional and student samples have shown that target gender has an effect on pain perception and management decisions, which is not resultant from the explicit use of such demographics in decision making but a result of unconscious bias (e.g., Weisse et al., 2003; Hirsh et al., 2010; Stutts et al., 2010). However, the direction of this bias is unclear, with conflicting results from study to study; this may be due, in part, to composite pain stimuli, which can include both verbal and nonverbal aspects. This experiment therefore examined target gender as a co-factor in nonverbal pain perception.

2. Method

2.1 Stimuli

Undergraduates ($N = 18$, 9 women) participated in a cold-pressor task while being videotaped. Participants were instructed to lower one of their bare forearms into a large container of water maintained at 4 ± 2 °C while facing the camera and to continuously move the arm lightly from side to side for as long as they could withstand the cold. Every 10 s, an experimenter asked each participant to rate how much pain he or she felt at the current moment, on a scale from 1 (*no pain at all*) to 10 (*very painful; have to take my hand out now*). The experimenter recorded the self-reported pain ratings at 10-s intervals for the duration of each immersion. Later, the still frames from the videos were extracted for the highest self-reported level of pain (pain level = 10). The background was cropped from these pictures, while colour was left intact to better convey shifts in blood flow (e.g., flushing or paling). Still frames were also extracted for pain levels 0–1, 3–4 and 7–8, where available, for each target. These were used to represent a sample of 'low pain' expressions, representing instances of mild discomfort that the targets themselves judged as not in need of relief. Here, we focused principally upon pain level 10, as that is the point at which the targets would be in need of assistance and most likely to present veridical expressions of pain.[1]

2.2 Participants

In total, 60 male and 60 female students in an introductory psychology course participated in the main portion of the experiment; 20 men and 20 women were assigned to each of the three conditions (40% Caucasian, 60% East/South Asian).

2.3 Procedure

Participants were asked to respond in writing to one of three prompts borrowed from Fowler et al. (2011), which served as experimental primes. In the masculinity prime condition, participants wrote about three instances in which they behaved in the following ways: 'I didn't back down from my ideas', 'I took on a leadership role' and 'I strove to be the best'. Participants in the femininity prime condition wrote about three instances in which they behaved in the following ways: 'I relied on others for help', 'I demonstrated selflessness' and 'I empathized with others' feelings'. In the

[1]Ratings of the facial expressivity of male and female targets made by a separate sample of participants showed no significant differences according to target gender [$t(18) = 0.90$; $p = 0.37$; $r = 0.21$].

neutral (control) condition, participants responded to three gender-neutral prompts, recalling instances of the following: 'I travelled by car', 'I took public transport' and 'I rode a bike'.[2]

Directly afterwards, participants completed the second part of the experiment, which was presented as unrelated. In this part, participants saw the photos of targets in pain, presented one at a time in random order, repeated in four randomized blocks. Each block asked participants to rate the stimuli on a single dependent variable: how much discomfort the target was in, how hurt the target appeared to be, how much the target needed help, and how much the target appeared to need pain medication. These four dependent variables were considered to collectively represent 'distress'.

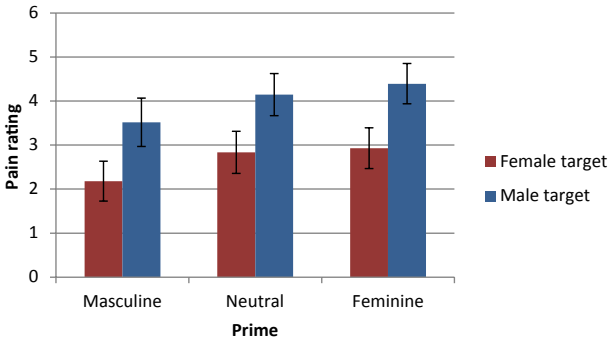

Figure 1 Effects of priming condition on distress composite ratings. Bars represent the mean score in each prime condition and variances indicate standard errors of the means for female and male target faces.

3. Results

The dependent variables (target upset, discomfort, need for help and need for pain medication) were submitted to factor analysis overall and at each combination of target gender and pain level; they were found to load onto a single factor (all variances explained >67%, Cronbach's $\alpha > 0.89$ for all iterations) and were therefore averaged to form a single composite variable of distress.[3]

Firstly, we wanted to ensure that subjects perceived targets in high pain as being more distressed than those in low pain. A linear contrast of the mean distress ratings of the photos extracted from the individual pain levels showed that participants' perceptions of target distress increased from the lowest pain level (0–1; $M = 1.66$; SE = 0.46), through intermediate pain levels ($M = 2.35$; SE = 0.48), up to the highest pain level (10; $M = 3.33$; SE = 0.48) [$F(119, 1) = 251.60$; $p < 0.001$; $\eta^2_{partial} = 0.68$]. Thus, perceivers accurately attributed the highest distress rating to the high-pain target expressions. However, participants grossly underestimated target pain at all pain levels; e.g., self-reported pain levels of 10/10 were perceived, on average, as a 3.3/10 by observers.

Next, we wanted to examine the effects of the gender primes on perceptions of distress in the high-pain expression group. A mixed-model analysis of variance (ANOVA) was run using the within-subject factor of *target gender* and the between-subject factor of *participant priming condition*.[4] This model showed a significant effect of target gender [$F(1, 117) = 247.90$; $p < 0.001$; $\eta^2_{partial} = 0.07$], such that men were seen as being more distressed than women; as well as a significant effect of priming condition [$F(2, 117) = 3.66$; $p < 0.03$; $\eta^2_{partial} = 0.06$; Fig. 1]. The interaction of target gender and priming condition was not significant [$F(2,117) = 0.30$; $p = 0.74$; $\eta^2_{partial} < 0.01$]. A planned contrast confirmed our prediction that distress perception increased linearly from the masculine condition to the neutral condition to the feminine condition ($p = 0.012$). Bootstrapped simple effects comparisons revealed that the masculine priming condition differed from the neutral priming condition [$t(78) = 1.95$; $p = 0.05$; $r = 0.22$] and the feminine priming condition [$t(78) = 2.63$; $p = 0.01$; $r = 0.29$]; the feminine and neutral conditions did not significantly differ, however [$t(78) = 0.55$; $p = 0.56$; $r = 0.06$].

4. Discussion

An individual's state of mind might influence his or her sensitivity to another person's pain. Here, we found that gender role primes affected the way that participants rated facial cues to distress and pain. Sup-

[2]A separate sample of participants rated the masculinity and femininity of the prompts as a manipulation check. Feminine prompts were seen as more feminine than masculine [$t(18) = 4.05$; $p < 0.001$; $r = 0.69$], masculine prompts were recognized as more masculine than feminine [$t(18) = 4.22$; $p < 0.001$; $r = 0.71$], and neutral prompts did not significantly differ in ratings of masculinity and femininity [$t(18) = 1.49$; $p = 0.15$; $r = 0.33$].

[3]A replication of the study using 'pain' as a single dependent variable showed similar results, with masculine primes leading to significantly lower perception of target pain [$F(2,45) = 4.55$; $p = 0.016$; $\eta^2_{partial} = 0.17$].

[4]A similar ANOVA including participant's gender as a between-subject factor showed no difference between male and female participants [$F(1, 114) = 0.02$; $p = 0.86$; $\eta^2_{partial} < 0.001$]; we therefore report the trimmed model here.

porting our hypothesis, participants primed with masculinity judged high-pain targets as less distressed than did participants primed with femininity. These results support the conjecture that pain perception can be easily manipulated (e.g., Chibnall and Tait, 1999; De Ruddere et al., 2011; De Ruddere et al., 2013). Moreover, the manipulations we used reflect circumstances that may often be encountered in the real world; it is easy to imagine that, in the competitive climate of a hospital or a clinic, health-care practitioners are encouraged to be the best in their group or field. Although such striving may be admirable, this encouragement may also promote a masculine mindset (Leszczynski, 2009), ironically hindering the practitioner's goal by interfering with the ability to be sensitive to patient distress. Indeed, physicians and nurses often underestimate patient distress (Choiniere et al., 1990; Marquié et al., 2003; Lesho et al., 2009), suggesting that factors related to the medical environment might contribute to a deficit in interpersonal sensitivity. Future research may wish to isolate candidate factors and directly test whether the often-competitive nature of the medical setting could actually undercut practitioners' performance.

Fortunately, our data also suggest that there may be a way to counter these effects. By consciously maintaining a less masculinized environment (e.g., one that focuses on collaboration, not only achievement), it may be possible to decrease the discrepancy between targets' self-perception of pain and observers' perception of the same pain in only a few minutes with only a minor intervention. Furthermore, we used a single prompt to successfully manipulate perceivers' pain ratings. It is therefore possible that if such prompts were recurrent over time, they might create a climate more amenable to sensitivity to nonverbal cues of pain.

The finding that women were perceived as experiencing less distress than men is surprising in light of previous research reporting that women were judged as experiencing more pain than men (Stutts et al., 2010). The suggestion that women may be over-medicated (or men under-medicated) by clinicians treating pain has been supported in some inpatient hospital settings (Visentin et al., 2005; Anthony et al., 2008). However, the reverse effect has been found in other studies. Riva et al. (2011) showed that participants were less accurate and slower in identifying pain on female faces when making judgements about the presence of pain in male and female targets. Similarly, Coll et al. (2012) found that participants judged pain in a male face to be increased in intensity, and pain in a female face to be decreased in intensity, when the participants themselves were experiencing discomfort. These findings are supported by actual events in the field, as it has been found that men receive more analgesics than women in pre-hospital (emergency room) visits for isolated extremity injuries (Michael et al., 2007).

This study chose to focus exclusively upon nonverbal pain cues. Therefore, the finding of pain medication over-prescription to women in certain contexts could simply represent the effects of other elements of communication superseding nonverbal cues in a situational manner. When considering research using pain ratings as an outcome, the results of this study support the findings of Riva et al. (2011), showing that female expressions of pain are slower and less accurately perceived. Although Stutts et al. (2010) found different results, they employed virtual human technology to create their target stimuli; therefore, it is possible that some level of expressiveness may have been lost, given that computer simulations of human faces imperfect.

With regard to virtual technology, it is of note that computer models using the facial action coding system (FACS) are quite accurate at judging target pain (Craig et al., 1991; Kunz et al., 2006; Ashraf et al., 2009). In these studies, men and women appear not to differ in expressiveness when FACS computer models are used to judge pain. Therefore, it is likely a human factor that biases participants to judge women as being in more pain than men at equal pain levels. The finding of under-perception of pain in female targets shown in this study might be explained by the differences in gender norms for nonverbal expression. Because women are encouraged to express emotion, whereas men are often taught to suppress it (Gross and John, 1995; Flynn et al., 2010), it is plausible that participants implicitly or explicitly assumed that women would more readily react to high pain levels than men – in other words, that it would take more pain for a man to show a given pain expression than it would for a woman to show the same expression. Additional research is needed to test this explanation directly.

Similarly, this departure from past findings could also be the result of a different participant pool. The present work is limited by its use of university undergraduates as participants. Extending this research to clinicians, health-care providers, or medical students as participants would be helpful for generalizing the findings to medical personnel. Furthermore, it would be optimal to use pictures with higher levels of distress, which could provide a closer approximation of the levels of pain typically requiring treatment with analgesic medication.

Despite these shortcomings, it is of value to know that pain perception is influenced by perceiver biases and that it is fairly malleable. Although there may be individual differences in overall sensitivity to nonverbal cues related to a number of factors (e.g., Hall and Andrzejewski, 2008), it is important to understand how situational variables can also exert similar effects. Such knowledge not only increases awareness of the importance of social-environmental variables for patient treatment but also provides opportunities for remediation of both situational and potentially idiosyncratic deficits in interpersonal sensitivity.

Indeed, the finding that ephemeral gender role primes can affect perceptions of distress has practical implications. There are many instances in daily life when gender roles would be primed (e.g., via media, apparel, social interactions), so it is reasonable to expect that the same effects found in this study could occur commonly in everyday life. In the medical environment, which is success-orientated and male-dominated both in absolute gender distribution (WHO, 2003) and in the prevailing social climate (Bickel, 2001; Risberg et al., 2009), it is reasonable to assume that physicians of both genders face a masculinized environment that can negatively impact pain perception. If something as apparently innocuous as a reference to accepting help can trigger increased perceptions of distress and need for medical attention, it is easy to see how bias could be both introduced and prevented in medical care. Research into such psychological effects on care administration would be valuable for assuring patient satisfaction and better health-care practices. Such research should aim to consider the perspectives of both the patient and the health-care practitioner, as it is the interaction of these perspectives that sits at the heart of the medical profession. In a time when medicine is becoming increasingly more personalized and patient-centred, it is important to understand the factors that could prejudice this idiosyncratic approach, both for the sake of being more self-aware and accountable during treatment, and to design rational countermeasures against this prejudice.

References

Anthony, M., Lee, K.Y., Bertram, C.T., Abarca, J., Rehfeld, R.A., Malone, D.C., Freeman, M., Woosley, R.L. (2008). Gender and age differences in medications dispensed from a national chain drugstore. *J Womens Health (Larchmt)* 17, 735–743.

Ashraf, A.B., Lucey, S., Cohn, J.F., Chen, T., Prkachin, K., Solomon, P. (2009). The painful face: Pain expression recognition using active appearance models. *Image Vis Comput* 27, 1788–1796.

Bickel, J. (2001). Gender equity in undergraduate medical education: A status report. *J Womens Health Gend Based Med* 10, 261–270.

Chibnall, J.T., Tait, R.C. (1999). Social and medical influences on attributions and evaluations of chronic pain. *Psychol Health* 14, 719–729.

Choiniere, M., Melzack, R., Girard, N., Rondeau, J., Paquin, M.J. (1990). Comparisons between patients' and nurses' assessment of pain and medication efficacy in severe burn injuries. *Pain* 40, 143–152.

Coll, M.P., Budell, L., Rainville, P., Decety, J., Jackson, P.L. (2012). The roles of gender in the interaction between self-pain and the perception of pain in others. *J Pain* 13, 695–703.

Coté, P., Cassidy, D., Carrol, L. (1998). The Saskatchewan health and back pain survey: The prevalence of neck pain and related disability in Saskatchewan adults. *Spine* 23, 1689–1698.

Craig, K.D., Hyde, S.A., Patrick, C.J. (1991). Genuine, suppressed and faked facial behavior during exacerbation of chronic low back pain. *Pain* 46, 161–171.

De Ruddere, L., Goubert, L., Prkachin, K.M., Stevens, M.A., Van Ryckeghem, D.M., Crombez, G. (2011). When you dislike patients, pain is taken less seriously. *Pain* 152, 2342–2347.

De Ruddere, L., Goubert, L., Vervoot, T., Kappesser, J., Crombez, G. (2013). Impact of being primed with social deception upon observer responses to others' pain. *Pain* 154, 221–226.

Deaux, K., Major, B. (1987). Putting gender into context: An interactive model of gender-related behavior. *Psychol Rev* 94, 369–389.

Eagly, A.H., Steffen, V.J. (1984). Gender stereotypes stem from the distribution of women and men into social roles. *J Pers Soc Psychol* 46, 735–754.

Elliot, A.M., Smith, B.H., Penny, K.I., Smith, W.C., Chambers, W.A. (1999). The epidemiology of chronic pain in the community. *Lancet* 354, 1248–1252.

Flynn, J.J., Hollenstein, T., Mackey, A. (2010). The effect of suppressing and not accepting emotions on depressive symptoms: Is suppression different for men and women? *Pers Individ Dif* 49, 582–586.

Fowler, S.L., Rasinski, H.M., Geers, A.L., Helfer, S.G., France, C.R. (2011). Concept priming and pain: An experimental approach to understanding gender roles in sex-related pain differences. *J Behav Med* 39, 139–147.

Fuchs-Lacelle, S. (2008). Pain assessment as an intervention: A study of older adults with severe dementia. *Clin J Pain* 24, 697–707.

Gill, M., Drendel, A.L., Weisman, S.J. (2013). Parent satisfaction with acute pediatric pain treatment at home. *Clin J Pain* 29, 64–69.

Gross, J.J., John, O.P. (1995). Facets of emotional expressivity: Three self-report factors and their correlates. *Pers Individ Dif* 19, 555–568.

Guereje, O., von Korff, M., Simon, G.E., Gater, R. (1998). Persistent pain and well-being: A World Health Organization study in primary care. *JAMA* 280, 147–151.

Hall, J.A. (1984). *Nonverbal Sex differences: Communication Accuracy and Expressive Style* (Baltimore, MD: Johns Hopkins).

Hall, J.A., Andrzejewski, S.A. (2008). Who draws accurate first impressions? Personal correlates of sensitivity to nonverbal cues. In *First Impressions*, N. Ambady, J. Skowronski, eds. (New York: Guilford Press) pp. 87–105.

Hall, J.A., Schmid Mast, M. (2008). Are women always more interpersonally sensitive than men? Impact of goals and content domain. *Pers Soc Psychol Bull* 34, 144–155.

Hanna, M., González-Fernández, M., Barrett, A., Williams, K., Pronovost, P. (2012). Does patient perception of pain control affect patient satisfaction across surgical units in a tertiary teaching hospital? *Am J Med Qual* 27, 411–416.

Hirsh, A.T., Jensen, M.P., Robinson, M.E. (2010). Evaluation of nurses' self-insight into their pain assessment and treatment decisions. *J Pain* 11, 454–461.

Hoffman, M.L. (1977). Sex differences in empathy and related behaviors. *Psychol Bull* 84, 712–722.

Jimenez, N., Moreno, G., Leng, M., Buchwald, D., Morales, L. (2012). Patient-reported quality of pain treatment and use of interpreters in Spanish-speaking patients hospitalized for obstetric and gynecological care. *J Gen Intern Med* 27, 1602–1608.

Kappesser, J., Williams, A.C. (2002). Pain and negative emotions in the face: Judgments by health care professionals. *Pain* 99, 197–206.
Kunz, M., Gruber, A., Lautenbacher, S. (2006). Sex differences in facial encoding of pain. *J Pain* 7, 915–928.
Lesho, E., Foster, L., Wang, Z., Sarmiento, D., Dennison, S., Vahey, M.T., Nolan, E., Smalls, C. (2009). The accuracy of physicians' perceptions of patient's suffering: Findings from two teaching hospitals. *Acad Med* 84, 636–642.
Leszczynski, J.P. (2009). A state conceptualization: Are individuals' masculine and feminine personality traits situationally influenced? *Pers Individ Dif* 47, 157–162.
Marquié, L., Raufastea, E., Lauqueh, D., Marine, C., Ecoiffierb, M., Sorumc, P. (2003). Pain rating by patients and physicians: Evidence of systematic pain miscalibration. *Pain* 102, 289–296.
Michael, G.E., Sporer, K.A., Youngblood, G.M. (2007). Women are less likely than men to receive prehospital analgesia for isolated extremity injuries. *Am J Emerg Med* 25, 901–906.
Risberg, G., Johansson, E.E., Hamberg, K. (2009). A theoretical model for analysing gender bias in medicine. *Int J Equity Health* 8, 28.
Riva, P., Sacchi, S., Montali, L., Frigerio, A. (2011). Gender effects in pain detection: Speed and accuracy in decoding female and male pain expressions. *Eur J Pain* 15, 985, e1–985.e11.
Stutts, L.A., Hirsh, A.T., George, S.Z., Robinson, M.E. (2010). Investigating patient characteristics on pain assessment using virtual human technology. *Eur J Pain* 14, 1040–1045.
Visentin, M., Zanolin, E., Trentin, L., Sartori, S., de Marco, R. (2005). Prevalence and treatment of pain in adults admitted to Italian hospitals. *Eur J Pain* 9, 61–67.
Weisse, C.S., Sorum, P.C., Dominguez, R.E. (2003). The influence of gender and race on physicians' pain management decisions. *J Pain* 4, 505–510.

Web reference

WHO (2003). Global Atlas of the Health Workforce. Geneva: World Health Organization. Retrieved from: http://apps.who.int/gho/data/node.main.A1449?lang=en&showonly=HWF (accessed on 3 April 2014).