Review of Psychology,
2010, Vol. 17, No 1, 69-74 UDC 159.9

Social context of pain perception: the role of other people's presence and physical distance

KORALJKA MODIĆ STANKE and DRAGUTIN IVANEC

The aim of this study was to investigate the importance of passive person's presence for the experience of pain induced by thermal stimuli in experimental conditions. Several previous studies suggested that mere presence of others can induce beneficial outcomes in people experiencing experimentally induced pain. Participants were involved in two different experimental situations – one in which they were completely alone in the room while experiencing pain and another in which they were, while experiencing pain, accompanied by an unfamiliar individual (passive observer), presented as unimportant for this experiment. There was no social interaction between participant and the passive observer during painful simulation. To explore more closely the possible nature of this effect of social context, the distance between passive observer and the participant was varied in this experiment. When participants were, during painful stimulation, accompanied by an unfamiliar individual, passive observer was in one group relatively close to the participant (50 cm), and in other group somewhat further away (150 cm). Measures of pain experience used in this study were pain threshold, pain tolerance, and also subjective assessment of intensity and general unpleasantness of pain experienced in this study. Results indicated no effect of other people's presence on pain experience. There was no difference, in any measure of pain experience, between situation in which people experienced pain alone and the one in which they were accompanied by an unfamiliar individual. No effect of distance and also no interaction of distance and presence of passive observer were found in this study.

Key words: experimentally induced pain, pain threshold, pain tolerance, social context

It is difficult, if not impossible, to study pain experience outside the context. Different prior experience (Dar, Ariely & Frenk, 1995), emotions (Rainville, Bao & Chrétien, 2005) and expectations (Koyama, Mchaffie, Laurienti & Coghill, 2005) are only several factors proven to be important in modulation of pain. Although nowadays there is a general agreement that pain perception is more than just result of nociceptive processes, and only few would try to diminish importance of contextual factors in experience of pain, the basic question of revealing relevant and stable contextual factors involved in pain perception still remains unanswered.

Perhaps most obvious example of context influencing pain experience is reflected in differences between pain perception and pain expression experienced in clinical and in experimental conditions (Kim, Neubert, Rowan, Brahim, Iadarola & Dionne, 2004). Differences in level of fear, uncertainty of outcome, duration of painful procedure, possibility of pain control, amount of stress and risk experienced in clinical conditions or accepted during participation in experimentally induced painful situations, are only some of the factors that probably contribute to different clinical and experimental pain experience. Because of these differences, results obtained in experimental conditions are somewhat difficult to generalize to other situations of pain experience in real life conditions.

One thing clinical and experimental situations have in common is the existence of social context. Doctors, nurses, family, friends and other patients; or experimenter, confederates, assistants and other participants - are almost always present during individuals' pain experience, expression and/or assessment. Due to complexity of social interaction between patient and medical personnel in clinical conditions, there are no surprises about the impact other people have on individual trembling over personal health and wellbeing and assessment of pain characteristics she/he is experiencing. However, the effect of presence and characteristics of other people on individuals' pain experience was found even in experimental conditions which are much simpler in that matter - with little or no uncertainty for wellbeing of participant. Gender and attractiveness of experimenter (Levine & De Simone, 1991; Gijsbers & Nicholson, 2005), experimenter status (Kállai, Barke & Voss, 2004; Campbell, Holder & France, 2006), assessor status (Williams, Park,

Koraljka Modić Stanke, Department of Psychology Faculty of Humanities and Social Sciences, Ivana Lučića 3, 10000 Zagreb, Croatia. E-mail: kmstanke@ffzg.hr (the address for correspondence).

Dragutin Ivanec, Department of Psychology Faculty of Humanities and Social Sciences, Ivana Lučića 3, 10000 Zagreb, Croatia.

Ambrose & Clauw, 2007) and social support (Montoya, Larbig, Braun, Preissl & Birbaumer, 2004; Patrick, 1996) are only a few contextual factors proven to play an important role in pain perception.

When role of social context in experimental condition is discussed, one usually implies the presence of people who, in one way or another, actively participate in the process of pain experienced by an individual (e.g. experimenters who conduct the research, confederates that observe, encourage and motivate participants). Unlike this active support paradigm - that usually involves presence of familiar or unfamiliar individual providing verbal or nonverbal support to the person in pain - passive support paradigm (mere presence of others) in pain research is much less to be found. Passive support paradigm excludes any verbal or nonverbal support provided by the person present towards the person in pain, and also presumes that individual experiencing pain would perceive mere presence of other people as kind of support. Study conducted by Brown, Sheffield, Leary & Robinson (2003) demonstrated analgesic effect of both active and passive support provided by an individual (a friend or a stranger) present during the cold pressor task experienced by the participants. Effect of passive support in experimental condition was also confirmed in study using thermal heat pain stimulus (Modić Stanke & Ivanec, 2008), where participants displayed greater pain thresholds and pain tolerance in the presence of unfamiliar passive observer.

In general, one might expect that people experiencing pain would take up those behavioral patterns that ease their pain, so it is reasonable to assume that during pain - if beneficial effects of social context on pain relief really exist - they would seek presence of others to relieve their discomfort. However, in real life conditions, individuals do not act in accordance to findings discovered in experimental conditions. Daily experience teaches us that individuals experiencing acute pain have tendency to avoid contact with other people. The question is why would people in painful situations spontaneously avoid presence of others, if that presence - as previously mentioned studies show - might have positive impact on their unpleasant experience of pain? One plausible explanation is the existence of moderating factor - personal space of individual in pain, namely possibility of invading that space in social situation that can lead to different impact of social context and, accordingly, different behavior of person experiencing pain.

Although psychologists were familiar with the concept long time before, increased interest for studying personal space took place in 1960s and 1970s. Personal space, defined by Sommer (1969) is "an area with invisible boundaries surrounding a person's body into which intruders may not come". Different studies revealed that these invisible boundaries are not invariant and that their distance depends on characteristics of both individual and situation. Personal space has two basic functions: communication and protection (Bell, Greene, Fisher & Baum, 1996), and different studies discovered association between invasion of personal boundaries and discomfort, feeling more pressured and irritated, stress, arousal and series of compensatory responses (withdrawal, flight, change in body orientation, avoidance of eye contact) that individual uses to reestablish equilibrium.

From everything mentioned above one can presume that introducing personal space in pain research studying effect of social context (presence of others) on experience of pain might play an important role in clarification of results concerning pain behavior in different social context. For example, presence of passive observer might produce "positive" effect on pain experience, namely, relief of discomfort associated with pain when person in question would maintain in appropriately large distance and would not invade personal boundaries of individual in pain, but might not produce the same effect when that distance is smaller and when person experiencing pain might feel threaten due to invasion of his/her personal boundaries. Based on these assumptions and results of a small body of research that studied a role of passive observer on pain experience, the goal of this study was to examine the effect of passive observer on experimentally induced pain experience and to test whether physical distance between passive observer and individual experiencing pain plays a role in that effect. Due to the lack of research in this field the outcome of this particular study cannot be clearly predicted, however, if the study confirms the effect of passive observer on decrease of pain expression and increase of pain tolerance and also reveals modification of that effect when physical distance of observer is taken into account – that would mean that social context, namely presence of others is not a universal factor defined only by its own characteristics but is also defined by certain characteristics of a situation.

METHODS

Participants

Participants were 48 healthy female psychology students between ages of 19 and 33 who volunteered to participate in a study on the pain experience, and were adequately reworded for it. Because of the sex differences in pain tolerance (Riley III, Robinson, Wise, Myers & Fillingim, 1998) and possible interaction of the sex of participants and the sex of experimenter on the pain experience (Levine & De Simone, 1991), all participants in this study were female. The possible effect of age, status and attractiveness of experimenter was controlled in the study - experiment was conducted by only one female experimenter. One passive observer, a 23-year-old female research assistant, stranger to participants was also included in the study.

Pain stimulation

Unpleasant (painful) stimulation was induced by the flow of hot air on the palm of participant's left hand. During painful stimulation, participant's left hand was fixated in a tube set at a distance of 11 centimeters away from the source of hot air. The purpose of this hand fixation was to prevent hand movement during unpleasant stimuli and to insure constant distance from the source of hot air to the participant's hand. The tube had a gap size 3.5 × 1.8 centimeters which limited stimulated area, and the temperature of hot air was 60 °C.

Study design

A 2 × 2 mixed factorial design was used in this experiment. Within subjects factor was social context (presence and absence of passive observer). Between subjects factor was physical distance (smaller of greater) between the passive observer and the participants. Participants were involved in two measurements (repeated measures): a) in the absence of passive observer - during painful stimulation participants were alone in the room, and b) in the presence of passive observer - during painful stimulation participants were in the presence of a passive observer who set quietly behind them and was prevented to make an eye contact with them. Participants were randomly assigned to experimental situation – half of them were at closer distance to passive observer (0.5 m) and half of them ware at larger distance to passive observer (1.5 m). Diagram of experimental design is presented in Figure 1.

To avoid the possible effect of the sequence of measurement, two situations (with and without passive observer) were rotated randomly – half of participants were alone in the first measurement, and the other half of them were alone in the second measurement. To avoid possible influence of memory, time interval between two measurements was one week. To control the influence of diurnal rhythm all participants attended both measurements at the same time of the day.

Experimental procedure

Upon participant's arrival to measurement, experimenter informed her about the fictive goal of research - study of the pain experience and the physiological reactions (body temperature, blood pressure, heart rate, respiration) that follow that experience in healthy and clinical population. The reason for this fictive goal was avoidance of paying attention to passive observer as important variable for the study and to prevent participant to consciously or unconsciously act according to hypothesis. If research assistant was present, she was introduced as a colleague who will conduct the same research on the clinical population and who, for the sake of uniformity, needs to observe the procedure. Participants were instructed to ignore the presence of the research assistant and were told that her presence was not relevant for the experiment. Afterwards, experimenter asked some questions about participant's current health and emotional status and measured her blood pressure and body temperature.

After questions about health and emotion status, experimenter placed electrodes for measurement of physiological reactions on the participant, and explained the procedure. Physiological reactions were just fictive measures, which served as a decoy to enhance credibility of the fictive goal of the study. Before unpleasant stimulation by the flow of hot air, participant hand was treated for 1.5 minutes by the flow of room temperature air in order to control the difference between skin temperatures of all participants. Participants controlled starting and ending of unpleasant stimuli by themselves. Their task was to endure painful stimuli for as long as they could. If the subject did not turn off apparatus during 120 seconds of stimulation, the task was terminated by the experimenter. Participants were not informed about this time limit. During unpleasant stimulation, participants' task was also to monitor their sensations and to express changes in development of sensation and pain by means of scale with five degrees: warm - hot - burns - painful - too painful to endure (implying at the same time the end of stimulation). Experimenter was never present in the room during painful stimulation, but she could communicate with participants (and was also able to hear their verbal reactions to painful stimuli) over the interphone. Immediately after painful stimulation was completed, participants were asked to rate the intensity and unpleasantness of the pain experience. At the end of second measurement, experimenter asked participant several questions regarding their experience in the study and their hypothesis about results. Ethical committee approved for conduction of this study and informed written consent was obtained from each subject prior to experiment.

Measures

Several measures of pain responsiveness were used: 1. *pain threshold* (length of time elapsed between the beginning of stimulation and a moment in which the subject reported first sensations of pain), 2. *pain tolerance* (length of time elapsed between the beginning and the end of unpleasant stimulation), 3. *pain intensity* at the very end of painful stimulation and 4. *pain unpleasantness* during entire pain-

	participants alone in the room	passive observer present
Group I (*n*=22)		distance to participant 0.5 m
Group II (*n*=21)		distance to participant 1.5 m

Figure 1. Mixed factorial design used in the study.

ful stimulation. Pain intensity and pain unpleasantness were both measured on the 10 cm long scale with left end indicating minimal and right end indicating maximal sensation.

RESULTS

The goal of the study was to test the difference in several pain measures between situation with and without passive observer (main effect of social context), with passive observer at closer or larger distance from the participant, and the interaction of context and distance. Descriptive statistics of each pain measure, for each group and experimental situation, are shown in Table 1. All data were entered into mixed ANOVAs, and analyzed with SPSS 17.0. Analysis excluded participants who took analgesic medication prior to experiment ($n = 2$) and those who declared that the real goal of the study was measurement of pain in social context ($n = 3$).

Results of statistical analysis are shown in Table 2. As one can clearly see, none of the effects was proven to be statistically significant. Presence of passive observer had no analgesic effect whatsoever - participants had the same experience of pain when they were in presence of unfamiliar individual as when they were alone in the room. The distance between passive observer and participants was also not an important factor - pain (expressed in all four measures) experienced when passive observer was close to participant was no different from pain experienced when that same unfamiliar individual was at larger distance from the participant. Also, no interaction of social context and distance was found in this study.

DISCUSSION

Although social factors are widely studied in the context of pain, relatively few researchers engaged in studying and later demonstrating possible analgesic effect of other people's presence in experimental conditions. Implications of such analgesic effect opened new possibilities for studying pain experience and behavior and, of course, pursuit for possible mechanisms of that effect. The hypothesis that physical distance of individual behaving passively towards the participant might contribute to different reactions on painful stimuli when compared to situation when participant is alone, was not confirmed by our results. In this *post hoc* moment, one logical question comes in mind: why would someone's presence alone impact the change of pain experi-

Table 1

Descriptive statistics associated with four measures of pain in four experimental situations. Values associated with pain thresholds and tolerance correspond to time length in seconds, and values associated with pain intensity and unpleasantness are assessments expressed on 10 centimeters long scale.

	Group distance 0.5 m		Group distance 1.5 m	
	alone	context	alone	context
pain threshold				
M	43.10	43.00	36.60	35.90
SD	19.82	26.48	16.35	22.81
pain tolerance				
M	77.20	75.20	67.40	60.70
SD	37.03	40.34	35.51	33.21
pain intensity				
M	7.60	7.80	7.20	7.50
SD	1.33	1.13	1.49	1.93
pain unpleasantness				
M	5.70	6.20	4.80	5.00
SD	2.03	1.79	2.07	2.14

Table 2

Results of analysis of variance associated with four measures of pain experience.

	Pain threshold		Pain tolerance		Pain intensity		Pain unpleasantness	
Effect	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Context	0.06	.94	1.2	.27	2.0	.16	2.85	.10
Distance	1.3	.27	1.36	.25	0.98	.33	3.5	.07
Context × Distance	0.001	.98	0.38	.552	0.17	.68	0.29	.60

ence? Although at first sight, and especially in the context of results given in this study, one might think that factors associated to presence of others are not relevant in pain perception – it is probably not a good idea to just jump to conclusions. Positive results indicated by several research studies (Kleck et al., 1976; Brown et al., 2003; Modić Stanke & Ivanec, 2008) still leave room for reasonable doubt that there's something about this effect after all. We can compare this with studies that investigated gender differences in pain perception. Numerous studies were preformed on that subject and all of them did not display uniform results. Certain studies demonstrated greater sensitivity in female subjects (Chesterton, Barlas, Foster, Baxter & Wright, 2003; Fillingim, 2000; Robinson, Riley III, Brown, & Gremillion, 1998) while others indicated no gender differences (Giles & Walker, 2000). Accumulation of studies showed more systematic differences associated, among others, with characteristics of experimental situation. Therefore, in time, researchers came to the conclusion that gender differences are more stable in context of mechanical and electrical stimulation, but not so systematic when cold stimuli are considered (see Riley III et al, 1998). Furthermore, concepts of sex and gender displayed need for further delaminating of factors when gender differences are considered (Robinson & Wise, 2003; Robinson et al., 2001). Analogously, more studies of social context are needed, for researchers to get the full picture about the role others play in pain perception.

Another question is - could positive effect of other people's presence might just be the outcome of socially desirable behavior in the presence of others (leaving the impression of strength and hiding weaknesses) and not actual analgesic effect of social context)? One thing that could possibly help in answering this fundamental question is monitoring participants' physiological reactions whilst experiencing pain within/outside of social context. In that sense, result that would contribute to analgesic effect of social context would have to indicate that changes in expressive component (pain thresholds and tolerance, assessment of pain intensity and unpleasantness, and pain behavior in general) are associated with physiological changes in participants – which are not, unlike the expressive component, under severe conscious influence of the individual in question. Former research in that area did not, however, result only in ambiguous results, but also in contradictory ones (Kleck et al., 1976; France & Stewart, 1995; Campbell, Holder & France, 2006; Aslaksen, Myrbakk, Hoifod & Flaten, 2007). Studies that would alongside usual measures also use some "objective" measures of pain experience are one of the methodological approaches researchers should follow.

In this study, socially desirable behavior that might be displayed in front of other person, i.e. in the situation of social context, was minimized. Even in experimental conditions one cannot fully exclude potential effect of other people's presence on socially desirable behavior because experimenter is virtually always present. However, his role and amount of communication with participant was minimized and balanced between subjects and situations. Furthermore, "social context" was unfamiliar individual without any notable characteristics that would provoke any social relationship with participant which could facilitate social responses. Perhaps passive individual, in the conditions of social context described above, was not even perceived in the way that could affect participant – and therefore, no effect was found. Besides this, above mentioned obstacle of socially desirable responses, possible hypothetic effect would be via certain positive or negative emotional states, expectancies, pain coping strategies that other person in the same room could facilitate – which might reflect on pain experience and behavior. If passive individual is perceived as "unimportant", perhaps that person did not even start a certain "process" that might be activated. Which of these variable constellations might lead to particular effect is certainly the subject of research to come. Another way of considering results of this research refers to statistical and methodological characteristics of conducted research. Namely, statistical power of research (determined post hoc) is not satisfactory (it is less than 0.50). This primarily reveals that, alongside characteristics of the measurement used in this research, the number of subjects was too small for the possible effect to appear. In table 1 one might notice large variability of results (SD), especially for the measures of thresholds and tolerance, which indicates existence of large individual differences. In such conditions (frequently found when pain thresholds and tolerance are used) one should plan larger number of subjects in a specific experimental situation. Furthermore, differences (effect size) that do exist are relatively small and one cannot see some systematic trend. Several positive results regarding possible importance of "passive others" in experimental conditions do offer certain guidelines suggesting the need for additional investigation, regardless non-existing effects of this research. Findings demonstrating absence of effect, if that is the actual case, are also relevant scientific information if the methodology of the research is adequate. In fact, one can often find only "positive" results in meta-analysis, because "negative" results were never published, which can of course lead to inaccurate generalization.

Postulation of gate control theory (Melzack and Wall, 1965) inspired a large amount of research that studied contextual factors of pain experience, and also declined conception that pain perception is direct reflection of nociception. In that time, implied mechanisms of pain modulation were primary located in spinal cord. Cumulating results from different studies postulate new central mechanisms. Melzack (1999) comes to syntagme *pain neuromatrix*, which represents number of anatomically functional structures of central nervous system that directly take part in modulation of impulses from nociceptors into experience that is reflection of large number of factors. A number of anatomic structures that are active in pain perception (such as ACC, prefrontal cortex, insula) are also involved in other cognitive-emotion-

al processes such as expectations and emotional reactions. Therefore there is potential foundation for the influence of different cognitive-emotional processes on transformation of information that arrives from nociceptors, like presence of others. Regardless the fact that results of this study did not confirm effect of passive individual's presence on different measures of pain, there is still not enough data to conclude that this factor is virtually irrelevant in the experience of pain.

REFERENCES

Aslaksen, P.M., Myrbakk, I.N., Hoifodt, R.S., & Flaten, M.A. (2007). The effect of experimenter gender on autonomic and subjective responses to pain stimuli. *Pain, 129*, 260-168.

Bell, P.A., Greene, T.C., Fisher, J.D., & Baum, A. (1996). *Environmental psychology*. Orlando: Harcourt College Publishers.

Brown, J.L., Sheffield, D., Leary, M.R., & Robinson, M.E. (2003). Social Support and Experimental Pain. *Psychosomatic Medicine*, *65*, 276-283.

Campbell, T.S., Holder, M.D., & France, C.R. (2006). The effects of experimenter status and cardiovascular reactivity on pain reports. *Pain, 125*, 264-269.

Chesterton, L.S., Barlas, P., Foster, N., Baxter, G.D., & Wright, C.C. (2003). Gender differences in pressure pain threshold in healthy humans. *Pain, 101*, 259-266.

Dar, R., Ariely, D., & Frenk, H. (1995). The effect of past-injury on pain threshold and tolerance. *Pain, 60,* 189-93.

Fillingim, R.B. (2000). Sex, gender, and pain: women and men really are different. *Current Review of Pain, 4*, 24-30.

France, C.R., & Stewart, K.M. (1995). Parental history of hypertension and enhanced cardiovascular reactivity are associated with decreased pain ratings. *Psychophysiology, 32*, 571-578.

Gijsbers, K., & Nicholson, F. (2005). Experimental pain thresholds influenced by sex of experimenter. *Perceptual and Motor Skills, 10*, 803-807.

Giles, B.E., & Walker, J.S. (2000). Sex differences in pain and analgesia. *Pain Reviews, 7*, 181-193.

Kállai, I., Barke, A., & Voss, U. (2004). The effects of experimenter characteristics on pain reports in women and men. *Pain, 112*, 142-147.

Kim, H., Neubert, J.K., Rowan, J.S., Brahim, J.S., Iadarola, M.J., & Dionne, R.A. (2004). Comparison of experimental and acute clinical pain responses in humans as pain phenotypes. *The Journal of Pain, 5*, 377-384.

Kleck, R.E., Vaughan, R.C., Cartwright-Smith, J., Vaughan, K.B., Colby, C.Z., & Lanzetta, J.T. (1976). Effects of being observed on expressive, subjective and physiological responses to painful stimuli. *Journal of Personality and Social Psychology, 34*, 1211-1218.

Koyama, T., Mchaffie, J.G., Laurienti, P.J., & Coghill, R.C. (2005). The subjective experience of pain: where expectations become reality. *Proceedings of the National Academy of Sciences USA, 102,* 12950-12955.

Levine, F.M., & De Simone, L.L. (1991). The effects of experimenter gender on pain report in male and female subjects. *Pain, 44*, 69-72.

Melzack, R. (1999). From the gate to the neuromatrix. *Pain Supplement, 6*, S121-S126.

Melzack, R., & Wall, P.D. (1965). Pain mechanisms: a new theory. *Science, 150* (3699), 971-979.

Modić Stanke, K., & Ivanec, D. (2008). Ovisnost doživljaja boli o socijalnom kontekstu [The dependence of pain experience on the social context]. *Suvremena psihologija 11*, 25-39.

Montoya, P., Larbig, W., Braun, C., Preissl, H., & Birbaumer, N. (2004). Influence of Social Support and Emotional Context on Pain Processing and Magnetic Brain Responses in Fibromyalgia. *Arthritis & Rheumatism, 50*, 4035-4044.

Patrick, L. (1996). Social support and functional status in chronic pain patients. *Canadian Journal of Rehabilitation, 9*, 195-201.

Rainville, P., Bao, Q., & Chrétien, P. (2005). Pain-related emotions modulate experimental pain perception and autonomic responses. *Pain, 118*, 306-318.

Riley III, J.L., Robinson, M.E., Wise, E.A., Myers, C.D., & Fillingim, R.B. (1998). Sex differences in the perception of noxious experimental stimuli: a meta-analysis. *Pain, 74,* 181-187.

Robinson, M.E., & Wise, W.A. (2003). Gender bias in the observation of experimental pain. *Pain, 104*, 259-264.

Robinson, M.E., Riley III, J.L., Myers, C.D., Papas, R., Wise, E., Waxenberg, L.B., & Fillingim, R. (2001). Gender role expectations of pain: relationship to sex differences in pain. *Journal of Pain, 2*, 252-257.

Robinson, M.E., Riley III, J.L., Brown, F.F., & Gremillion, H. (1998). Sex differences in response to cutaneous anesthesia: a double blind randomized study. *Pain, 77*, 143-149.

Sommer, R. (1969). *Personal space.* New Jersey: Prentice-Hall.

Williams, D.A., Park, K.M., Ambrose, K.R., & Clauw, D.J. (2007). Assessor Status Influences Pain Recall. *The Journal of Pain, 8*, 343-348.