

Pain threshold – Measure of pain sensitivity or social behavior?

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The aim was to examine the effect of the experimenter's social status and its interaction with participant's gender on pressure pain threshold. Both male and female students participated in the study ($N = 96$) and were evenly assigned into two groups which differed only in the professional status of the experimenter who was a professor (higher status) in one group and a student (lower status) in the other. The factorial ANOVA revealed statistically significant and large main effects of the experimenter's status and the participants' gender, indicating higher pain thresholds in male participants and in the higher status experimenter group. Although both males and females had higher pain thresholds when measured by a higher status experimenter, a statistically significant interaction revealed that status affected male participants more so than females. The obtained results are probably due to social behaviour, emphasizing relevance of the experimenter's and participants' characteristics in pain measurement.

Keywords: experimenter's status, pain threshold measurement, participants' gender

Nociceptive pain has a distinct protective function – drawing attention, alarming about the possibility of tissue damage and ensuring that a person acts on it. For example, the average person reports pain when the skin is heated above 45°C (Hall, 2010); if a temperature of approximately 45°C denaturates tissue protein and elicits damage in all subjects (Dafny, 1997), pain thresholds in all subjects should be about the same. The results of numerous studies suggest that variations in pain thresholds, compared with pain tolerance, are perhaps not as considerable as concluded by Merskey and Spear (1967), because the pain threshold is more dependent on physiological factors, while pain tolerance is more dependent on psychological factors. This, however, does not imply that pain thresholds are resilient to psychological factors and therefore will not change as a result of manipulation in pain measurement. Although psychological factors were not even considered to be relevant before the publication of the gate theory half a century ago (Melzack & Wall, 1965), it has been generally agreed for decades that pain is a highly subjective experience, susceptible to changes

both within the person experiencing pain and in the outer context in the broadest sense of the word.

A large body of studies examined the role of various psychological factors in different aspects of pain experience – here we will focus on the studies measuring pain threshold and/or pain tolerance. Personality (Buxton & Perrin, 1992; Gouber, Cromez, & Van Damme, 2004), previous experience (Dar, Ariely, & Frenk, 1995; Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004), expectations (Defrin, Shramm, & Eli, 2009), gender/sex (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley III, 2009) and the social context in which pain occurs (Montoya, Larbig, Braun, Preissl, & Birbaumer, 2004; Modić Stanke & Ivanec, 2008) are just a few of many factors proven to contribute to differences in pain threshold and pain tolerance. Only two of the above mentioned factors, namely gender and social context, are the subject of the present study.

When the experience of pain is investigated, social context is inevitable due to the mere presence of people conducting the research. Several recent studies (both in experimental and clinical conditions) investigated and demonstrated the effect of the experimenter on different aspects of pain. Levine and De Simone (1991) investigated the effect of experimenter gender on pain reports of male and female participants in experimental conditions and discovered that men reported less pain on the cold pressor task in front of an attractive female experimenter compared to a male experimenter with the same characteristics; women displayed no such gender-related bias. Similar results were obtained in an experiment conducted by Gijsbers and Nicholson (2005), where male participants tested by a woman dressed in a manner that emphasized her gender displayed higher pressure pain thresholds than did male participants tested by a man dressed in a manner that emphasized his gender; again, no such differences were found in women. Wise, Price, Myers, Heft, and Robinson (2002) pointed out that interactions between the experimenter's and the participants' gender have not been found in studies where the experimenter's appearance was not purposely highlighted for gender cues; therefore, it is possible that accentuated stereotypical gender characteristics of masculinity and femininity mediate the effect of experimenter gender on different aspects of pain in experimental conditions.

Alongside gender, the professional status of the person conducting the research seems to play a role in different aspects of pain experience – in both clinical and empirical studies. Williams, Park, Ambrose, and Clauw (2007) discovered a status-driven bias in recalling postprocedural pain reportings; although pain reports of two groups of patients did not differ immediately after a painful procedure, recalled pain ratings two weeks after the procedure were 86% higher (i.e. worse) in the group contacted by a research assistant (lower status) compared with the group contacted by the treating physician (higher status). Kállai, Barke, and Voss (2004) investigated not only gender effects, but also the effect of the experimenter's professional status on pain responsivity in both male and female participants. Apart from showing that participants rated the pain induced by the cold pressor task as more intense when tested by

female experimenters, the results also indicated that participants tolerated pain longer when tested by an experimenter of higher status and when tested by an experimenter of the opposite sex. Although contrary results was expected, no differences were found in pain thresholds, so the authors postulated that being tested by an experimenter of higher status did not affect pain perception nor pain reports but that this motivated the participants to endure pain longer, possibly due to higher importance attributed to the experiment when it was conducted by a professional. In an attempt to explain how and why professional status affects different aspects of pain experience, Campbell, Holder, and France (2006) conducted a similar experiment in which male experimenters of different professional status tested female participants on the cold-pressor task. The results indicated that participants displayed lower pain unpleasantness ratings and higher pain tolerance when tested by a higher status experimenter, and the authors suggested that physiological arousal could be the mediator of the relationship between experimenter status and pain.

When pain is studied in laboratory conditions on healthy participants, it is experimentally induced by several methods (e.g., pressure, heat/cold, electrical stimuli) and there are several aspects of pain which could be studied (e.g. pain thresholds, tolerance, ratings of unpleasantness and intensity). However, the results of studies that compared different aspects of pain depending on the way it had been induced are quite ambiguous – some studies obtained significant positive correlations between pain modalities (Bhalang, Sigurdsson, Slade, & Maixner, 2005; Harris & Rollman, 1983; Neddermeyer, Flühr, & Lötsch, 2008), while others found no correlations between responses to different noxious stimuli (Janal, Glusman, Kuhl, & Clark, 1994; Neziri et al., 2011). Since the effect of professional status on pain responsivity was previously investigated and demonstrated using only a cold pressor task (Campbell et al., 2006; Kállai et al., 2004), the question arises whether this effect can be generalized for other pain modalities. In addition, the results of previously mentioned studies demonstrated the effect of professional status on pain tolerance and unpleasantness, but – contrary to what was expected – not on pain thresholds. It is possible that obtained inconsistencies are due to the selection of pain modality i.e., the type of noxious stimuli. For example, the meta-analysis conducted by Riley III, Robinson, Wise, Myers, and Fillingim (1998) determined that pressure pain and electrical stimulation produced the largest difference between men and women for both pain threshold and pain tolerance, while this effect was smaller and more variable for the rest of the pain modalities. The selection of another method, one that is more influenced by sex/gender, would possibly be more appropriate for testing the effect of social context – it might be more sensitive to displaying differences in pain thresholds depending on the professional status of the experimenter and also demonstrate the interaction between sex/gender and professional status.

Therefore, with the intention to further investigate the importance of social context in pain measurement – revealing to what extent the experimenter's and participants' characteristics determine different aspects of pain experience – the purpose of this study was to examine the effect of the social status of

the experimenter, the participants' gender and their interaction on pressure pain threshold and pain unpleasantness. If the above-mentioned effects of social context were found to be general and likely to appear in any measurement of pain, such findings might have both theoretical and methodological implications. In the theoretical sense, the implications might provide a better understanding of the origin of such an effect and postulate hypotheses about it, much like the one suggested by Campbell et al. (2006) about the mediating role of arousal. Methodologically speaking, any information about social factors that can affect different measures of pain experience – and to which extent one should control them – is of great importance when conducting pain research.

Based on the idea that manipulation of social context would elicit changes in pressure pain threshold that are congruent with those previously obtained in pain tolerance and unpleasantness, we expected a statistically significant main effect of the experimenter's status on pain threshold and unpleasantness. Participants tested by the higher status experimenter were expected to have higher pain thresholds and lower pain unpleasantness in comparison with participants tested by the lower status experimenter. Assuming that social behaviour is important in pain threshold measurement, as was the case of pain tolerance measurement, we expected to find an interaction between the experimenter's status and the participants' gender. Influence of social status was expected to be greater in male than in female participants.

Method

This research followed the ethical principles for conducting research with human participants. Participation in the study was voluntary and the participants were thoroughly informed about every aspect of the research procedure before they gave their consent.

Participants

Based on the available data from two studies that investigated the relationship between experimenter status and different aspects of pain (Campbell et al., 2006; Kállai et al., 2004), effect sizes (indicated as Cohen *d*) ranging from small to moderate (0.26 – 0.62) were calculated. With the desired power (0.80) and expected moderate effect size, using G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007) a sample size around $N = 90$ was recommended. Accordingly, it was decided that the entire group of 96 first-year undergraduate psychology students (27 male and 69 female), all taking the course in experimental psychology with the same professor, was to participate in the study. The male participants were between 18 and 24 years of age ($M=19.78$; $SD=1.50$) and the female participants were between 18 and 24 years of age ($M=19.42$; $SD=1.12$). The participants were divided randomly into two groups, taking into account the unequal and relatively low number of male participants in comparison to female students; when the numbers in one group were filled, the rest of the male participants were assigned to the other group. The participants were recruited during laboratory practice for the same course they were attending and all students enrolled in this course consented to participate in the study as part of their laboratory practice.

Experimenters

The measurements were conducted by two male experimenters differing in professional status – a professor (aged 49), teaching the psychology course in which all participants were

enrolled and a third-year undergraduate psychology student (aged 22). Both experimenters received extensive instructions and training in the procedure and usage of the algometer. Selection of these two experimenters was based on a natural situation which gave reason to believe that the two experimenters would be perceived in a clearly different way. The higher status experimenter was the participant's lecturer in the experimental psychology class, believed to be perceived as an authority figure by his students. On the other hand, the lower status experimenter was a student who clearly differed in those status characteristics; this was believed to be adequate operationalization of the possible effect of the difference between experimenters.

Measures

The measurements were conducted with a hand held pressure algometer (FDX Compact Digital Force Gage, Wagner Instruments, CT, USA), a non-invasive electronic device used to determine the sensitivity to pressure pain threshold by gradually increasing the amount of pressure over time on a specific part of the body until the moment the participant stated that the stimuli had become painful. The algometer has a 1 cm² flat rubber tip to avoid tissue damage, with a digital display on which current pressure force and maximal pressure force are displayed in Newtons (N), the absolute units of force. The application rate for all participants on all four measurement points in both groups was approximately 15 N/second.

Procedure

Measurements were conducted for each participant individually, in an isolated chamber with only the participant and the experimenter present. The procedure was identical for both groups, the only difference between groups being the status of the experimenter – higher in one group (professor) and lower in the other (student). Neither the participants nor the two experimenters had any knowledge of the research hypotheses; the need for having two experimenters was explained as practical due to time and space requirements during the measurements. When a participant entered the chamber, the experimenter explained the procedure and made sure that the participant understood the task. The experimenter made sure that each participant understood the difference between the pain threshold and pain tolerance and clearly stated that the task of the research was not the measurement of pain tolerance, but of pain thresholds.

The measurement was conducted while the participant was seated with his or her hands placed on the table. After the experimenter explained the task to each participant, one trial measurement was conducted by placing the probe of the algometer on the upper part (nail) of the middle finger – this was done to familiarize the participants with mechanical pressure as a form of inducing painful stimuli and also to make certain participants knew that pain threshold and not pain tolerance was being measured. During the actual measurement, the probe of the algometer was applied to four measurement points in the following order: 1) upper part (nail) of the little finger of the left hand, 2) upper part (nail) of the little finger of the right hand, 3) upper part (nail) of the index finger of the left hand and 4) upper part (nail) of the index finger of the right hand. These locations were chosen because they are, due to their size, differently sensitive to mechanical pressure and are also highly accessible.

The above mentioned order of measurement was the same for all participants in both groups and each time the probe was applied to the finger, the experimenter increased the pressure slightly. In all four measurements the participants were asked to inform the experimenter when they *started to feel pain*, and at that very moment the experimenter stopped applying pressure. The final, highest pressure per measurement that was applied at the same time the participant informed the experimenter of the pain threshold was displayed by the algometer (units expressed in Newtons) and noted by the experimenter. Both experimenters were previously trained to work with the algometer in order to decrease possible differences

in the perception of competence that might result from differences in experience of the two experimenters. The algometer was placed in such a way that would not allow participants to see their results, which prevented any competition with themselves or other participants. Finally, the mechanical pressure that corresponded to each participant's personal pressure pain threshold on the little finger of the left hand was applied once on the upper part (nail) of the little finger of the left hand for approximately 10 seconds, and the participants' task was to rate pain unpleasantness on a scale from 0 (not unpleasant) to 10 (highly unpleasant). Individual measurements, including the time for detailed instructions, were carried out in approximately three minutes per participant and the participants were asked not to discuss their impressions concerning the measurement and the experiment in general with their colleagues.

Results

IBM SPSS Statistics (version 21, NY, USA) computer software was used for data analysis. The measures of pain thresholds included two anatomically different measurement points (index finger and little finger), each measured on both the left and the right hand. The results of previous studies concerning possible asymmetry between pressure pain thresholds were inconsistent; in some studies that took lateralisation and hand domination into account, some differences between left- and right-sided locations were found (Özcan, Tulum, Pinar, & Başkurt, 2004; Pauli, Wiedemann, & Nickola, 1999), while in others this was not the case (Cathcart & Pritchard, 2006; Greenspan & McGillis, 1994; Maquet, Croisier, Demoulin, & Crielaard, 2004). Since no data on hand domination were gathered in this study, and some studies have advocated aggregation of bilateral combinations of pain threshold values, because aggregation across different body parts will lead to less reliable measures (Lacourt, Houtveen, & Van Doornen, 2012), the results of pressure pain threshold at the same measurement point on the left and right hand were taken together to calculate the mean result (expressed in Newtons), separately for each of the two anatomically different measurement points.

Correlations between different pain measures were also calculated. The correlations between the thresholds measured at the index finger and at the little finger were very high (professor experimenter $r(47) = .97$; $p < .01$; student experimenter $r(45) = .87$, $p < .01$). In the three-way ANOVA (social status \times participant's gender \times finger index/little) the main effect of anatomically different measurement points was statistically significant. The pain threshold was higher at the index finger, as expected $F(1, 92) = 29.01$, $p < .001$. However, no statistically significant two-way interaction was found (finger \times status) $F(1, 92) = 0.24$, $p = .65$; finger \times gender $F(1, 92) = 0.53$, $p = .47$; nor was there a three-way interaction finger \times status \times gender $F(1, 92) = 2.23$, $p = .14$. Based on the obtained results of 1) high correlation among several threshold measures and 2) no three-way interaction status \times gender \times finger, it was decided to present the data for one threshold measure only (averaged threshold of both hands and two fingers).

An independent two-way ANOVA (social status \times participant's gender) was conducted to address all three hypotheses. The assumptions for conducting

ANOVA were also tested. In each of the four experimental situations, distributions were normal. However, Levene's test of error variance equality was statistically significant $F(3, 92) = 8.43, p < .001$. According to Gamst, Meyers, and Guarino (2008) large group variances associated with small sample sizes tend to produce a liberal F statistic, so it was decided to perform an ANOVA but to set the alpha level to $p = .01$. Since unequal gender distribution could violate findings of a research, bootstrap method was conducted to examine if this was the case in the present study. Results demonstrated 95% confidence intervals very similar to those obtained in the regular ANOVA model, demonstrating the robustness of the obtained effects.

No correlation was found between the pressure pain threshold and the assessment of pain unpleasantness. Descriptive statistics for each pain measure by groups are shown in Table 1. The analysis of variance yielded significant differences for the experimenter's professional status, the participant's gender and their interaction in pressure pain thresholds (Table 2). The calculated partial eta square indicated large effect sizes (Cohen, 1988) in all but one situation – the medium effect size for calculated interaction between gender of participant and status. The results indicated that the participants displayed higher pain thresholds when the higher status experimenter conducted the measurement. Furthermore, female participants displayed lower pressure pain thresholds in comparison to male participants. Although pain thresholds were higher in both groups when the experimenter was a professor, the difference was greater in male participants.

Table 1
Descriptive statistics associated with the two pain measures in the four experimental groups

measure	participant	experimenter professor			experimenter student		
		<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
pain threshold	male	13	121.20	20.27	14	52.10	10.56
	female	36	72.30	26.32	33	43.90	6.81
pain unpleasantness	male	13	4.92	1.49	14	4.21	2.08
	female	36	5.58	1.68	33	5.0	1.44

Note. The values associated with pain thresholds correspond to the pressure force displayed in Newtons (N), and the values associated with pain unpleasantness are assessments expressed on 11 point scale, ranging from 0 (not unpleasant) to 10 (extremely unpleasant)

Table 2
The results of the independent two-way ANOVA-s with associated effect sizes (partial eta squared) for the pain thresholds measured with the factors of experimenter professional status and participant gender

Source	<i>df</i>	MS	<i>F</i>	<i>p</i>	η_p^2
Experimenter status	1	46001.19	131.78	<.001	.59
Participant gender	1	15780.86	45.21	<.001	.33
Status × Gender	1	8042.01	23.04	<.001	.20
Error	92	349.07			

Pairwise comparisons (simple effects) additionally described the obtained interaction effect. There was a statistically significant difference between pain thresholds obtained by the professor and the student among both male and female participants (both $p < .001$). However, the difference between male and female participants was obtained only when the experiment was conducted by the higher status experimenter ($p < .001$). Such a difference did not exist when the participants were tested by the lower status experimenter ($p = .17$). The analysis of variance did not yield significant differences for the experimenter's professional status $F(1, 92) = 3.0, p = .09$, participant's gender $F(1, 92) = 3.76, p = .06$, or their interaction $F(1, 92) = 0.08, p = .87$ in the assessment of pain unpleasantness.

Discussion

Regarding the professional status of the experimenter, it was hypothesized that a higher professional status of the experimenter would be associated with higher pressure pain thresholds, and that this would be the case for all participants. The results obtained in the present study not only displayed the expected differences related to experimenter status, but, moreover, as seen from the calculated partial eta squares, these differences were robust. Although in accordance with studies conducted by Kállai et al. (2004) and Campbell et al. (2006), the results of the present study are both relevant and intriguing since previous studies found this effect on other pain measures, namely pain tolerance and pain unpleasantness, but not on the measure of pain threshold. Kállai et al. (2004) suggested that participants in the pain tolerance task are motivated to endure pain longer due to the accentuated importance of the experiment when it was conducted by an experimenter of higher status. Since the pain threshold, as measured in the present research, actually represents the moment in which the participant *concludes* that the intensity of pressure increased enough to become painful and *decides* to declare this – authors of the present study wonder if a similar motivational explanation be applicable to differences in pain thresholds, as obtained in the present study.

Statistically significant interaction effects of participant gender and experimenter status on pressure pain thresholds revealed that although both men and women had higher pain thresholds when these were measured by a higher status experimenter, the differences were greater for men. In fact, no gender differences in pressure pain thresholds were found when the experiment was conducted by the lower status experimenter, which means that the main effect of gender was primarily due to being tested by the higher status experimenter. The important question is why do male participants engage in such behaviour. Was it because the higher status experimenter additionally emphasized their social role and “compelled” them to engage in “extra manly” behaviour or perhaps because the higher status experimenter induces stress in men differently than in women? Based on the hypothesis that the baroreflex system plays a role in modulating

nociception, Campbell et al. (2006) suggested that the presence of a higher status experimenter enhances participants' blood pressure reactivity which then leads to reduced sensitivity to painful stimuli. Although this explanation of the results obtained in their study was plausible, in the present study – since no physiological measures were obtained – no data can be found to either support or reject this hypothesis. The results of the present study question the conventional point of view that pain thresholds are more dependent on physiological rather than psychological factors, and suggest that the pain threshold could be a measure of social behaviour at least as much as it is a measure of pain sensitivity.

In our opinion, the observed results are probably due to social behaviour. The effect size of the largest observed difference (pressure pain thresholds in male participants tested by higher and lower status experimenter) is very large (Cohen $d = 4.49$ ($121.2 - 52.1/15.4$ /pooled SD)). It is not likely that an effect size so large can be attributed to any physiological process activated by the manipulation of the experimenter's professional status. Absence of gender differences in pressure pain thresholds when the participants were tested by the lower status experimenter is also in accordance with the social behavior hypothesis. The results of several previously mentioned studies (Gijsbers & Nicholson 2005; Levine & De Simone, 1991) have shown that different aspects of pain in women are less affected by social influence. Aslaksen, Myrbakk, Hoifodt, and Flaten (2007) investigated pain perception and found observed differences not to be correlated with physiological markers of pain; thus, they concluded that the effect of experimenter gender was probably due to psychosocial factors.

Robinson et al. (2001) demonstrated that men generally believe that they can endure pain better than women, which is in accordance with the results obtained by Pool, Schwegler, Theodore, and Fuchs (2007), who found an interaction of participants' gender and gender identification in expected pain tolerance. While there was no difference in the expected pain tolerance between men and women that had low identification with their gender roles, such a difference was found between men and women that had high identification with their gender roles – high-identifying men indicated that they would have higher pain tolerance. The same relations were detected in their second study, where the real pain tolerance, instead of the expected pain tolerance, was measured.

Men and women have a history of being raised in compliance with stereotypical social roles – women are expected to be fragile, gentle, and emotional, in need of assistance and protection by strong, stable, dependable, protective and always-in-control men. One can assume a similar analogy concerning the observed effect of social status in the present study. Consciously or unconsciously, the participants, men especially, wanted to present themselves as less sensitive to pain in front of their professor, which in the social context reflects gender roles. Furthermore, as previously mentioned, big differences in variances were found between two experimental situations regarding different experimenter status. Differences in variances of such magnitude could likely be due to different social behaviour of the participants and making a “good impression” in front of a person of authority, which resulted in differences in pain thresholds.

Regarding the effect of experimenter status on pain unpleasantness, the results of the present study were neither in accordance with the hypothesis nor with the results of previous studies. While it was expected that participants would display lower assessments of pain unpleasantness in front of the higher status experimenter; the results indicated no statistically significant differences. It is possible that pain thresholds are associated with the sensory-discriminative aspect of pain while pain unpleasantness is associated with the affective-motivational aspect of pain. Additionally, when applying pressure force that corresponds to the participants' pain threshold for several seconds – it is possible that since pain thresholds imply barely noticeable pain, participants accordingly feel very little or no unpleasantness. The question arises whether measuring pain unpleasantness in such situations even makes sense. It is therefore suggested that experimenters use pain unpleasantness as a measure of pain sensitivity with higher pain intensities (e.g., when measuring pain tolerance).

The present study cannot offer a clear explanation of the results displayed as the nature of this research is primarily descriptive. However, the results are in accordance with previous studies and therefore raise the question of potentially great effects of social factors in pain measurement – both in experimental and clinical conditions. Researchers studying pain are very much aware of the large variability in pain self-ratings and its dependence on numerous psychosocial factors; though researchers frequently try to compensate for this limitation by using some less subjective indicators (e.g., heart-rate, skin conductance) it is observed that correlations between such indicators and subjective assessments of pain are quite small or even non-existent. Researchers have recently begun using brain activity to indicate the presence of pain and measure pain intensity. Marquand et al. (2010) were pioneers in trying to apply fMRI and machine learning algorithms to the problem of objective pain measurement. Two additional studies (Brown, Chatterjee, Younger, & Mackey, 2011; Wager et al., 2013) were conducted with the same goal and all had a certain amount of success in predicting pain based on monitoring and analyzing brain activity alone. However, this method is still far from accurate, which is required and needed in pain research, as pain self-ratings are regarded as the gold standard of pain measurement at the present time and probably for the foreseeable future. The present study, alongside other studies, demonstrates that some psychosocial factors are powerful modulators of subjective ratings, where we cannot be certain if they are the result of pain modulation or social behaviour. Nevertheless, the results of studies like this clearly show that, from the methodological point of view, one must acknowledge the potential effect of the status of the person gathering information on pain. Since pain is almost always experienced in some form of social context – even several studies conducted on rodents (Aghajani et al., 2013; Gioiosa, Chiarotti, Alleva, & Laviola, 2009; Langford et al., 2006; Langford et al., 2011) suggest that the effect of social context on pain experience goes beyond the human race – future studies are strongly advised to take social context into account.

Methodological considerations

This study was primarily interested in the effects of the experimenter's status on the pain threshold for mechanical pressure, so only pain thresholds and pain unpleasantness associated with it were measured. In order to get a better and more holistic insight into different aspects of pain when different status experimenters are present, further research should address the same problem by including other pain measures – pain tolerance, the assessment of pain unpleasantness associated with it and also the assessment of pain intensity. We suggest this should be done using a design similar to Kállai et al. (2004), where, apart from the participants' gender and professional social status of the experimenter, one would also take into account the gender of the experimenter as there is reason to believe that it interacts with the above mentioned variables. Additionally, to help clarify whether the observed differences are the result of pain modulation or social behaviour, further research should include the monitoring of physiological measures and a short post-measurement interview – to examine whether the participants were aware of what was being measured and also if they consciously changed their behaviour.

Generally speaking, the high variability problem is quite conspicuous in the field of pain measurement, and the present study was no exception. Although this problem can be addressed by introducing initial measurement in the present study design we decided against it, for several reasons. First of all, we consider total sample size of 96, divided randomly into two groups sufficient to control for individual differences. Next, there is a strong possibility of an interaction effect between measurement order and independent variable (e.g. Ivanec, Miljak, & Faber, 2010; Ivanec, Pavin, & Kotzmut, 2006), one that might largely change the outcome of the study. Finally, with the initial measurement in our experiment we would be at risk of another (not so negligible!) problem – that neither participants nor the experimenters would be entirely naive regarding the real purpose of the measurement – which would in fact be the largest threat to internal validity concerning our research problem.

Differences between experimenters in the present study were referred to as the professional status of the experimenter. This was clearly visible from the participant's point of view, but it is not quite clear what exactly contributes the most to the obtained differences. Apart from formal professional status (professor-student), differences in other characteristics like age, personality, height or any of numerous different characteristics could have contributed to differences in pain thresholds observed in the present study. Therefore the conclusion that the obtained differences are the result of experimenter's professional status must be taken with a certain amount of precaution. The fact is, there are numerous differences between two experimenters that could contribute to the general observed difference – regarded as professional status.

It is possible to manipulate the experimenter status in numerous ways; in the present study we seized the opportunity to operationalize status in natural conditions i.e. we used the existing differences between student and professor.

In that way we could obtain only partial information regarding the role of experimenter characteristics in pain threshold measurement. Although extensive generalization of the results obtained in this study is merely potential, what stands out in this work is that pain threshold not only depends on the gender of a person experiencing pain but also on the status of the person measuring it.

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