The impact of pain information on pain intensity

An experimental study on violation of expectations and conflicting information

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The idea for this study was first proposed from our supervisor, Martien Schrooten. After working separately away from our supervisor, on ideas and solutions on how to do the experiment, the research design was created by incorporating our ideas into our supervisors proposal. The recruitment of participants was mainly done by us students, with a little help from research assistant, Jessica Jansson. The data collection was done by the students only.

The introduction and method section was written by the students with feedback given twice from the supervisor. The data analysis was done by the students with guides from the supervisor. The results and discussion was written by the students with feedback given once from the supervisor.
Sammanfattning

Tidigare forskning har visat att det är flera komponenter involverade i en smärtupplevelse, bland annat sociala och psykologiska faktorer såsom förväntningar. Ett kallvattentest utfördes för att undersöka positiv/negativ information och dess påverkan på upplevelsen av smärta. Vi undersökte även om smärta påverkas av en kognitiv konflikt skapad av en disconfirmation av en smärtförväntning. 106 deltagare (49 män och 57 kvinnor) fick hålla sin hand i 5°C vatten i en minut. Vårt mätinstrument var själv-rapporterad smärta vid kallvattentestet. Resultatet visade att deltagare som fick negativ information upplevde mer smärta än de som fick positiv information. Det fanns ingen signifikant skillnad mellan de som blev disconfirmed och confirmed i sin förväntan och inte heller någon skillnad mellan grupperna i upplevd kognitiv konflikt. Detta första försök att undersöka smärta och kognitiv konflikt kan bli till en inspiration för vidare undersökningar.

_Nyckelord: _Kallvattentest, förväntningar, smärta, kognitiv konflikt_
Abstract

Previous research has shown that there are several components involved in how we perceive pain, e.g. social and psychological factors such as expectations of pain. A cold pressor experiment was conducted to investigate the impact of negative/positive information on pain perception. We also investigated if a cognitive conflict created by disconfirming information of a pain expectation influences the pain experience. 106 participants (49 men and 57 women) got to hold their hand in 5°C water for 1 minute. The main outcome variable was self-reported pain during the cold pressor test. The results show that participants receiving negative information perceived more pain than the group receiving positive information. There was no significant difference in pain perception between those who were confirmed or disconfirmed in an expectation, nor was there a difference in cognitive conflict between the two groups. This is a first attempt to explore pain and cognitive conflict and can work as an inspiration for further investigation.

Keywords: Cold pressor test, expectations, pain, cognitive conflict
Cognition and the experience of pain

Let’s say that you are at the dentist. You have a certain expectation about the dental treatment and how it is going to feel. The dentist says “You have a cavity and we need to drill it”. You might react with horror to the upcoming procedure, thinking it will hurt a lot. Without asking how you feel and what your expectations are, the dentist tries to reassure you by telling you “My patients usually don’t think this hurts”. Will this information, that is actually positive but not in line with your expectations, affect your pain perception negatively? This incongruence between information about others’ pain experience and own expectations about pain may generate in a cognitive conflict, a field that has been largely ignored in the pain literature.

Pain is a common problem in our society, according to SCB 63.9% woman and 45.5% men between the age of 16-34 in Sweden, are suffering from pain (Statistiska Centralbyrå, 2006). For some it is enough to take a painkiller to get rid of pain but for others this is not enough, and the problems might become chronic. Pain usually starts in the body, but soon it can influence one’s mind and then the entire life (Ojala, Häkkinen, Karppinen, Sipilä, Suutama, Piirainen, 2014). However pain is often overseen by the health practitioners and do only have a little coverage in medical schools. Practitioners such as healthcare providers, doctors and nurses often focus on the symptoms and the disorder, and see the pain as a by-product, even though it is the most urgent issue for the patient (Taylor, 2015). Pain is something individual and we need to take into account, not only biological factors but also sociological and psychological factors as well (Eisenberger, 2012; Koyama, McHaffie, Laurienti & Coghill, 2005; Ojala, Häkkinen, Karppinen, Sipilä, Suutama & Piirainen, 2014). As emphasized by the International Association for the Study of Pain, pain is defined as “An unpleasant sensory and emotional experience associated with actual or potential
tissue damage, or described in terms of such damage” (International Association for the Study of Pain, 2005).

Even though we do know that cognitive factors such as negative thoughts and beliefs may increase the pain (Linton & Shaw, 2011), more research need to be conducted to increase the understanding within the psychological field of pain.

Expectations

A cognitive factor that often reappears in pain research is the impact of pain-related expectation on perception of pain. In our daily life we meet situations that create expectations about future pain outcomes, as the example with the dentist mentioned above. We know that expectation is a cognitive factor that has shown to have an impact on our pain experience. The more pain we expect - the more pain we experience (Atlas & Wager, 2012; Bingel et al., 2011; Koyama, McHaffie, Laurienti & Coghill, 2005; Rose, Geers, Rasinshi & Fowler, 2012; 2011). A way to study expectations influence on pain is through placebo analgesia studies. Placebo analgesia is known as an experienced physiological or psychological pain relief that is due to expectations of a substance or procedure and not to the specific nature of the treatment (Atlas & Wager, 2012; Liberman, 1962). Nocebo hyperalgesia is the opposite of placebo and refers to a high pain expectation that leads to increased pain. The placebo analgesia phenomenon has been investigated numerous times by giving verbal instructions to manipulate the participant’s expectation (Atlas & Wager, 2012). How much an expectation effects the pain experience is dependent on how certain we are of the expectation. Certainty of a high pain expectancy will increase the pain while certainty of a low pain expectancy will reduce pain intensity (Brown, Seymour, Boyle, El-Deredy & Jones, 2008). However, according to more previous studies uncertainty increases the pain intensity (Yoshida, Seymour, Koltzenburg & Dolan, 2013). This was shown in a study where
participants received vicarious information about others experience of the upcoming pain stimuli that was either certain or uncertain. The result showed that when the participant was presented with more uncertain information they rated higher on perceived pain (Yoshida, Seymour, Koltzenburg & Dolan, 2013). Expectations about pain can also cause fear, and fear is a predictor of how much pain is perceived. Patients with low reports of pain-related fear report less intense pain than those who report high on pain-related fear (McCracken, Gross, Aiken & Carnrike, 1996). Fear of pain is associated with an overestimation of pain and expectations, which lead to avoidance of possible pain-related experiences (Asmundson, Norton & Norton, 1999). In conclusion, our expectations can affect our pain experience both positive and negative.

**Social context**

Our expectations and pain experiences does not exist in a social vacuum. We get exposed to pain related situations daily, when our social surroundings share their pain expectations and experiences. How we experience pain is not only dependent on the individual, but also on the situation and people surrounding us (Gatzounis, Schrooten, Crombez & Vlaeyen, 2012). A model that describes social features of pain is The Communications Model of Pain (Hadjistavropoulos, Craig, Duck, Cano, Goubert, Jackson & Fitzgerald, 2011). This model directs attention to social processes such as causes and consequences of experienced pain and how it is expressed. How the person in pain will experience and express the suffering is depending on the observer’s response to the expressed pain behaviour (Craig, 2009; Hadjistavropoulos, Craig, Duck, Cano, Goubert, Jackson & Fitzgerald, 2011). This model states that our social surroundings do affect our pain experience. Since the social context do influence our pain perception, we think that a part is missing in this model. We would like to explore how the social context influences the pain before the pain experience has begun.
A message about the upcoming pain can be positive (others perceived low pain) or negative (others perceived high pain). This message can be reassuring but also conflicting if it is not in line with one’s one expectation. When approaching a painful experience, health practitioners and people around us try to calm us down by giving reassuring messages. But for a message to be reassuring it needs to include both physical and psychological information that are relevant for the receiver (Linton, McCracken, & Vlaeyen, 2008). It reduces concerns directly and is associated with higher satisfaction (Pincus, et al, 2013). If not give in a right way, a reassuring message could backfire (Linton, McCracken, & Vlaeyen, 2008). Could it be that a positive but incongruent message, with the intention of being reassuring (e.g., "My patients usually don’t think this hurts"), instead creates a conflict?

**Cognitive conflict**

Another cognitive factor that could have an impact on our pain perception is when experiencing a cognitive conflict. Patients may feel a cognitive conflict, when information is obtained from different sources (Carpenter, DeVellis, DeVellis, Fisher, Hogan & Jordan, 2010). Inconsistency between different information and sources can result in anxiety and uncertainty (Pollock, Grime, Baker & Mantala, 2004). This is an area that has received little attention in pain research, and needs further investigation. A cognitive conflict is when one's own beliefs and knowledge does not match with new experiences and information (Santrock, 2011). Experiencing a cognitive conflict can trigger aversive signals and a person experiencing a cognitive conflict faster connects to negative targets (Dreisbach & Fischer, 2012). This was confirmed in a study where participants, after receiving an incongruent message faster recognised negative targets, such as negatively loaded pictures and words, than after receiving a congruent message. When receiving a congruent message the participants faster recognised positive targets.
than when receiving an incongruent message (Dreisbach & Fischer, 2012). An incongruent message creates a conflict with aversive signals, which leads to a person easier connecting to negative targets. Can an incongruent message - which creates a conflict - also increase a negative experience, such as pain perception?

**This study**

In this study a pain test will be conducted on university students to investigate the impact of pain information on pain perception. Previous research has shown that positive information decrease pain perception while negative information increase the pain. What have not yet been explored is the impact of confirming and disconfirming information on the pain intensity. The purpose of this study was to investigate if information influences our pain perception, with a focus on (1) negative/positive information and (2) disconfirming/confirming information. It was also a first attempt to explore whether disconfirming information of a pain-specific expectation could create a cognitive conflict and whether that conflict increases the pain experience. (3) Furthermore we wanted to investigate whether there was an interaction effect between positive or negative information and others disconfirming or confirming experience on pain perception.

In line with precious research we hypothesise that (1) negative information (others perceived high pain) will enhance the subjective perceived pain perception in comparison to positive information (others perceived low pain). (2) No previous research has been conducted on the relationship between cognitive conflict and pain. But based on studies about cognitive conflict and aversive signal we hypothesise that: If disconfirming information creates a cognitive conflict (as reflected in negative emotions and uncertainty about own pain expectation), subjective perceived pain will be higher when the information disconfirms the participants first expectation, than
when the information confirms the first expectation. (3) If disconfirming information creates a cognitive conflict (as reflected in negative emotions and uncertainty about own pain expectation) the negative disconfirmed group will experience most pain.

**Method**

**Participants**

106 students (48 male, 58 female, Mage=22.81, SD=2.29) took part in the study at Örebro University. The inclusion criteria were that participants had to be between 18 to 30 years old and fluent in Swedish. The exclusion criteria were prior experience with the cold pressor test, open cuts, wound or big scar on their non-dominant hand. Hand or arm fracture on their non-dominant hand and recently experienced accident or surgery. History of; seizures (epilepsy), Raynaud’s syndrome, frostbites caused by extreme cold or very high blood pressure and circulation problems.

Participation was voluntary and based on written informed consent. The participants were informed that they could stop whenever they wanted without any negative consequences. They were informed that the test could be unpleasant before signing the informed consent. In exchange for participating the participants received “fika”. They also received a lottery number to a christmas-lottery, in which they could win one out of three Örebro City gift certificates of a value of 250SEK each.

**Measures/material**

The measurement used was self-report and the participants gave their answers on Likert scales. Questions were asked before, during and after the cold pressor test.

**Pain test.** A cold pressor test was used as an experimental pain test. This test is valid and reliable and commonly used to elicit pain (Edens & Gil, 1995). The advantage of using the cold pressor procedure is that it can generate significant pain without causing any tissue damage (Sullivan, Bishop & Pivik, 1995). The cold pressor
test was performed by immersing the hand into a cold-water container, with 19 liters of water. The water was kept stable, with a cooling aggregate, *Julabo Immersion coolers FT200*, and a circulation pump, *ED Heating immersion circulator*, at 5°C, the same temperature as used in several other studies (Mitchell, MacDonald & Brodie, 2004; Peters, Vancleef, Hanssen & Vlaeyen 2014). The participants were instructed to put their hand in the water with the water level up above their wrist. Keep the palm downwards all the time, not make a fist or move their fingers and not rest the hand at the bottom or the walls of the container.

Perceived pain intensity, during the cold pressor test, was rated on an 11-point Likert scale measuring from 0 (“no pain at all”) to 10 (“very much pain”). Pain ratings were given verbally through the intercom system four times. Three times when the participant had their hand in the water, at 20, 40 and 60 seconds. Then participants took their hand out of the water and held it above the water bath. After 20 seconds participants rated pain intensity for the fourth time. The fourth measurement is used in previous studies, and is standard procedure when performing the cold pressor test (Mitchell, MacDonald & Brodie, 2004; Peters, Vancleef, Hanssen & Vlaeyen 2014). For this study when analysing the data, we will in order to answer our hypotheses, only use the three pain ratings given when the hand was in the cold water.

To stabilize the participant’s skin-temperature before the cold pressor test, a plastic container with room temperature water was used. The water was about 20°C but no information about the water temperature was given to the participants. The water was checked with a thermometer between participants so that the temperature was constant, if needed warm/cold water was added.

**Self-report questions before pain test.** To measure fear, pain-specific expectations and certainty of expectation for the upcoming test, two questions about
each variable were asked. One dichotomous and the other one on a numerical rating scales. The scale used was an 11-point Likert scale measuring from 0 (”not at all fearful/painful/certain”) to 10 (”very much fearful/painful/certain”). (See appendix 3).

**Fictitious information.** The fictitious information was given in a dichotomous way depending on the dichotomous question of expected pain, low painful or high painful. This design was inspired from a study where participants made social judgments and then received fictitious feedback (Somerville, Kelley, Heatherton, 2006). The information was given in a controlled format, via the intercom system. Information were either positive or negative and a match or a mismatch with the participants expectation. Half of the male/female participants who rated “high” on expected pain were confirmed “Most previous male/female participants in your age find this test to be high painful” and half were disconfirmed “Most previous male/female participants in your age experience low pain”. Half of the male/female participants who rated “low” on expected pain were confirmed, “Most previous male/female participants in your age find this test to be low painful” and half were disconfirmed, “Most previous male/female participants in your age find this test to be high painful.”

**Self-report questions after pain test.** Since a cognitive conflict is perceived as a negative event (Dreisbach & Fischer, 2012) the participants were asked to answer a shortened, Swedish version of the 16-item modified Differential Emotions Scale. The scale was ranging from 1 (“Not at all”) to 7 (“very intense”) (Izard, Dougherty, Bloxom, & Kotsch, 1974) and 10 adjectives were used, (see appendix 5). Differential Emotions Scale is a reliable self-report scale widely used in self-reports of emotional feelings (Youngstrom & Green, 2003). To analyse the data from the modified Differential Emotions Scale the positive emotions were computed into one positive
affect score and the negative emotions were computed into one negative affect score. This was done in line with previous research (Schaefer, Nils, Sanchez, Philippot, 2010). Three groups of items were analysed as positive: “joyful, happy, amused”, “interested” and “satisfied, pleased”. The inter-item reliability for the positive scores were $\alpha=0.62$. Five groups of items were analysed as negative: “sad, downhearted, blue”, “angry, irritated, mad”, “fearful, scared, afraid”, “anxious, tense, nervous” and “ashamed, embarrassed”. The inter item reliability for the negative scores were $\alpha=0.56$. Calm and surprised were excluded from the analysis since no information was given if they were used as positive or negative in previous study.

To measure if the participant changed their expectation after receiving manipulating information a dichotomous questions were asked retrospectively. Expectations and certainty of expectation after receiving information were also asked after the test. This was answered on an 11-point Likert scale measuring 0 (“not at all painful/certain”) to 10 (“very much painful/certain”). How threatening and comforting the participant thought the information was, were asked on a 11-point Likert scale measuring 0 (“not at all”) to 10 (“very much”). Finally to measure how (un)pleasant the message was perceived, the participants were asked to rate (un)pleasantness on a Likert scale measuring -5 to 5 (very unpleasant - very pleasant). (See appendix 5).

**Procedure**

**Pilot.** Before conducting the cold pressor test a pilot study was done to investigate the distribution of pain-specific expectations among male and female students at the university. This was done to see if there was going to be an equal distribution among male and female and high painful and low painful expectations with a water temperature of 5°C. Short written information about the cold pressor test procedure was given, much like given in the lab. Including temperature of the water,
instructions of hand placement and how long time the participant would be asked to hold his/her hand in the water. The participant then got to answer if they expected the task to be high painful or low painful. 90 participants were asked (51 females, 38 males and 1 other). 56 participants (34 females, 22 males) expected the task to be low painful and 34 participants (17 females, 16 males) expected the task to be high painful. Based on this pilot a decision was made, to proceed with a water temperature of 5°C, expecting a slightly skewed distribution.

**Recruitment.** The participants were recruited at Örebro University through advertisement at campus with flyers and during lectures. They were told that the study was evaluating an alternative to the traditional cold water test procedure in healthy people living in Sweden/northern Europe. A cover story was needed since the study builds on the participants believing in the fictitious information. The true purpose of the study was not revealed until everyone had been tested. Participants who were interested in conducting the study received an information letter by email with information about the test and what they would receive in return for participating. The email also contained ethical “guidelines” letting them know that their answers and personal data would be confidential. They were also told that they could interrupt the experiment at any time without any further explanation. After reading the information letter they could decide if they wanted to participate or not. If they were still interested in taking the test they could book an appointment by email or text.

**Lab session.** The participants were tested one by one at the CHAMP experimental laboratory. There were two rooms in the laboratory, the test room that contained the cold pressor test, a container with room temperature water and one computer. The second room was the control room, from which the experiment leader could see and hear the participant through the intercom system all the time. They
could also see what answer the participant provided on the computer in the test room. To ensure that the answers given was as honest as possible and not influenced by the experiment leaders, the experiment leader stayed in the control room at all times except when giving instructions. If a participant could not be included because of a exclusion criteria or not meeting the inclusion criteria, the participants was debriefed and received the same reward as the other participants.

**Start session.** When entering the laboratory the participant was asked to switch off their phone and also to take off their coat and bag. They were asked to sit down by the computer desk and read the written information carefully about how the cold pressor task would be conducted. They were also asked to give demographic information and confirm that they meet the in/exclusion criteria for the study. Based on the information given, informed consent was signed, (see appendix 1 & 2). When done with the forms a signed through the intercom system was given to the experiment leader. The experiment leader would then enter the test room and look thru the forms to see whether the participant qualified for the test.

**Standardize skin temperature.** The participant was asked to remove bracelets, rings and jewellery from their non-dominant hand. They got to standardize their hand by immerging their non dominant hand in a water container with room temperature water, about 20°C, for one minute. This was done so that all the participants would have around the same skin temperature from the beginning of the test. It was emphasized that this was not the cold-water test. They got instructed how to hold their hand in the water-bath (palm downward, not rest the hand at the bottom of the container or touch the walls of the container, not make a fist and not move fingers) and that they were supposed to hold their hand in the same position in the cold water container. No information about the temperature of the water was given.
Expectancy ratings. The participant answered six questions on the computer, (see appendix 3). During that the time the experiment leader was not in the test room, but in the separate experimenter room. Depending on gender and the answer the participant provided at question nr 2.1 (see appendix 3) the experiment leaders prepare for giving manipulating information.

Confirming or disconfirming manipulating information. After completing the six questions the participant got verbally informed through the intercom system that she/he was now going to perform the cold water test, the fictitious information was also given at that time. “Now it’s time to perform the cold water test. Most previous male/female participants in your age find this test to be high/low painful.”

Pain test. After giving information the experiment leader went back into the test room to show the participant the cold-water test and where to sit. An 11-point Likert scale ranging from 0-10 was handed out to the participant, from which he/she was asked to rate the perceived pain from, during the cold-water test, (see appendix 4). The experiment leader went back to the control room and asked the participant to immerse his/her hand in the cold-water container. The participant was asked to verbally rate how much pain was experienced at 20, 40 and 60 seconds. After 60 seconds the participant was instructed to raise his/her hand and hold it above the water surface. How much pain was perceived was again asked at 20 seconds after taking up the hand from the water bath.

Participant who did not complete the test and withdrew their hand before one minute had passed were asked to hold the hand above the water surface. They verbally rated their perceived pain right after taking the hand out of the water and 20 seconds after taking up their hand from the water. Afterwards they completed the questions on
the computer as usual. These participants received the same reward as the participants who fulfilled the one minute in the cold water test.

**Retrospective ratings of perceived conflict and information.** After the cold pressor test the participant went back to the computer, dried of his/her hand and answered retrospective questions about the perceived conflict and what they thought about the verbal information that was given, (see appendix 5).

**Debriefing.** When finished with the questions the participant gave a signal through the intercom system and the experiment leader went back to the test room and debriefed him/her. The participant were told that they could tell others that they had placed their hand in cold water and answered a few questions, but were asked not to tell others what questions they had answered throughout the session and their experience of the test, so that every participant would start with the same information. Furthermore they were told that they would receive an email with contact information and a lottery number to the Christmas lottery. And that the purpose of the study and the winning lottery numbers would be announced through email after all participants had been tested. The participant were dismissed and welcomed to go and have fika in the hallway.

Because of the fictitious information the participant were shortly debriefed after the session to make sure they were feeling alright. The participants were then debriefed by email about the real purpose of the study. They also got the experiment leaders, experiments supervisor and independent researchers contact information if they had any further questions. All emails were sent separately to keep the participants confidential.

**Sample characteristics**
Three participants were excluded from the statistical analysis. Two were excluded due to procedure error and one was excluded because of technical problems. This resulted in final total sample of 103 participants, 47 male and 56 female. Out of this sample 78 participants (34 male, 43 female) initially expected the test to be low painful, 39 of this participants was confirmed and 39 participants was disconfirmed. 25 participants (12 male, 13 female) initially expected the test to be high painful, 12 of these participants were confirmed and 13 participants were disconfirmed. Overall 51 participants were confirmed (24 male, 27 female) and 52 participants (23 male, 29 female) were disconfirmed. Further group characteristics are given in Table 1.

**Strategy for analyses**

SPSS 20.0.0. was used to analyse the data. To answer our first and second hypothesis two independent sample t-tests were performed. The interaction effect was analysed with a 2x2 factorial ANOVA, because the Levine’s test was significant 4 different t-test were performed to compare the four different groups. The answers of the differential emotional scale was analysed with one 2x2 factorial ANOVA for the positive emotions and one 2x2 factorial ANOVA for the negative emotions. Also a 2x2 factorial ANOVA was performed to analyse the group’s differences in certainty of expectation. The retrospective ratings about the fictitious information was analysed with three separate 2x2 factorial ANOVA. In addition a chi-square test was performed to see whether there was an association between the four groups and change of expectation after the fictitious information.

**Results**

The four group which was analysed were: *Confirmed negative* – the group expecting high pain and received negative information (others perceived the test as high painful), confirming their expectation. *Confirmed positive* – the group expecting
low pain and received positive information (others perceived the test as low painful),
confirming their expectation. *Disconfirmed negative* – the group expecting low pain
and received negative information (others perceived the test as high painful),
disconfirming their expectation. *Disconfirmed positive* – the group expecting high
pain and received positive information (others perceived the test as low painful),
disconfirming their expectation.

Table 1.
*Gender, age and ratings before the cold pressor test (CPT) per group.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Confirmed Negative</th>
<th>Confirmed Positive</th>
<th>Disconfirmed Negative</th>
<th>Disconfirmed Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>N per group</td>
<td>12</td>
<td>39</td>
<td>39</td>
<td>13</td>
</tr>
<tr>
<td>Gender Male/Female</td>
<td>6/6</td>
<td>18/21</td>
<td>17/22</td>
<td>6/7</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>24.00 (1.81)</td>
<td>22.41 (2.27)</td>
<td>22.67 (2.31)</td>
<td>23.38 (2.47)</td>
</tr>
<tr>
<td>Fear of CPT Yes/No</td>
<td>1/11</td>
<td>1/38</td>
<td>0/39</td>
<td>0/13</td>
</tr>
<tr>
<td>Mean Fear of CPT (SD)</td>
<td>1.33 (1.78)</td>
<td>0.49 (0.64)</td>
<td>0.36 (0.74)</td>
<td>1.38 (1.19)</td>
</tr>
<tr>
<td>Mean expectation pain (SD)</td>
<td>6.92 (0.79)</td>
<td>2.51 (1.39)</td>
<td>2.13 (1.64)</td>
<td>6.38 (0.96)</td>
</tr>
<tr>
<td>Certain of expectation Yes/No</td>
<td>5/7</td>
<td>14/25</td>
<td>14/25</td>
<td>3/10</td>
</tr>
<tr>
<td>Mean certainty of expectation (SD)</td>
<td>5.33 (2.93)</td>
<td>4.85 (2.61)</td>
<td>5.62 (2.68)</td>
<td>4.00 (2.27)</td>
</tr>
</tbody>
</table>

**Pain ratings**

Out of the 103 participants, two participants withdrew their hand before one
minute had past: two girls who expected low pain with one being disconfirmed in this
expectation, and the other confirmed. Therefore the analyses on the pain ratings were
conducted on a sample of 101 participants.

In order to answer the hypotheses the main dependent variable is mean pain
rating during the cold pressor test (across the three time points). Pain ratings during the
cold pressor test for all three times points are presented in Table 2.

Table 2.
*Pain ratings for the three different time-points during the cold pressor test (CPT) and
the mean pain rating across this three time.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Confirmed Negative</th>
<th>Confirmed Positive</th>
<th>Disconfirmed Negative</th>
<th>Disconfirmed Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain ratings 20 sec (SD)</td>
<td>7.58 (1.68)</td>
<td>5.13 (2.42)</td>
<td>5.54 (1.95)</td>
<td>6.00 (1.53)</td>
</tr>
</tbody>
</table>
Hypothesis 1: negative information will enhance the subjective perceived pain perception in comparison to positive information

An independent sample t-test comparing the mean pain rating during the cold pressor test between positive and negative information showed that the group receiving positive information experienced significantly less pain (M=6.18, SD=2.11), than the group receiving negative information (M=6.98, SD=1.81), t(99)=-2.04, p<.05. See figure 1. This means that the participants who received negative information (others perceived the test as high painful) perceived more pain than those receiving positive information (others perceived the test as low painful).

<table>
<thead>
<tr>
<th></th>
<th>Pain ratings 40 sec (SD)</th>
<th>Pain ratings 60 sec (SD)</th>
<th>Mean pain rating during CPT (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive information</td>
<td>8.68 (1.07)</td>
<td>8.58 (1.00)</td>
<td>8.28 (1.00)</td>
</tr>
<tr>
<td>Negative information</td>
<td>6.38 (2.47)</td>
<td>6.63 (2.31)</td>
<td>6.03 (2.32)</td>
</tr>
<tr>
<td>Positive/negative info</td>
<td>6.77 (2.03)</td>
<td>7.58 (2.14)</td>
<td>6.57 (1.82)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.92 (1.12)</td>
</tr>
</tbody>
</table>

![Figure 1](image.png)

Figure 1. Pain perception after receiving positive information or negative information.

Hypothesis 2. Subjective perceived pain will be higher when the information disconfirms the participant’s first expectation, than when the information confirms the first expectation.
An independent sample t-test comparing the mean pain rating during the cold pressor test between disconfirming and confirming information showed that overall there was no significant difference in pain ratings between the group whose expectation was confirmed (M=6.57, SD=2.29) and the group whose expectation was disconfirmed (M=6.59, SD=1.69), \( t(90.07) = -0.05, p > .05 \). See figure 2. This indicates that the participants did not differ in pain ratings when confirmed or disconfirmed.

![Figure 2](image.png)

**Figure 2.** Pain perception after receiving confirming or disconfirming information.

**Hypothesis 3.** If disconfirming information creates a cognitive conflict the negative disconfirmed group will experience most pain.

The 2x2 factorial ANOVA, with pain information (positive and negative information) and (dis)confirmation as between-group factors and mean pain rating as dependent variable, showed a main effect of pain information \( F(1,97) = 6.15, p < .05 \), (hypotheses 1), but no main effect of (dis)confirmation \( F(1,97) = 1.55, p > .05 \), (hypotheses 2). However there was a significant interaction effect between pain information and (dis)confirmation, \( F(1,97) = 6.98, p < .05 \). See figure 3.
Figure 3. Interaction between positive/negative and disconfirming/confirming information.

Levene’s tests showed that the assumption of equality of variance was not meet, likely related to the different group sizes. Therefore, we decided to conduct independent t-tests to test the most relevant group differences with an adjustment of the degrees of freedom. We keep in mind that conducting several t-tests increases the risk of type 1 error.

The group receiving negative confirming information perceived more pain (M=8.28, SD=1.00) than the group receiving negative disconfirming information (M=6.57, SD=1.52), \( t(34.64)=4.13, p<.05 \). However, there was no significant difference in pain ratings between the groups receiving positive confirming information (M=6.03, SD=2.32) and positive disconfirming information (M=6.64, SD=1.27), \( t(38.59)=-1.19, p>.05 \). The group receiving negative confirming information experienced more pain (M=8.28, SD=1.00) than the group receiving positive confirming information (M=6.03, SD=2.32), \( t(43.02)=-4.74, p<.05 \). There was no significant difference between the group receiving positive disconfirming information
(M=6.64, SD=1.27) and the group receiving negative disconfirming information (M=6.57, SD=1.82), t(49)=0.13, p>.05.

In conclusions there was an interaction effect between positive/negative information and confirming/disconfirming information. The group who perceived most pain were the participants who received negative, confirming information.

**Ratings after pain test: cognitive conflict**

We assume that perceived cognitive conflict would be reflected in negative affect (and lower positive affect) and uncertainty about pain expectation. Positive and negative affect scores are presented in Table 3, along with ratings of expectation change and certainty of expectation after receiving the fictitious information.

**Table 3. Ratings after the cold pressor test per group.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Confirmed Negative</th>
<th>Confirmed Positive</th>
<th>Disconfirmed Negative</th>
<th>Disconfirmed Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of expectation: No/Yes</td>
<td>9/3</td>
<td>26/13</td>
<td>11/28</td>
<td>7/6</td>
</tr>
<tr>
<td>Mean certainty of expectation (SD)</td>
<td>6.75 (3.55)</td>
<td>6.51 (2.67)</td>
<td>2.49 (2.46)</td>
<td>4.46 (2.85)</td>
</tr>
<tr>
<td>Mean positive affect DES (SD)</td>
<td>3.53 (1.21)</td>
<td>3.38 (1.28)</td>
<td>3.31 (0.98)</td>
<td>3.87 (1.24)</td>
</tr>
<tr>
<td>Mean negative affect DES (SD)</td>
<td>1.85 (0.60)</td>
<td>1.53 (0.62)</td>
<td>1.73 (0.61)</td>
<td>1.52 (0.47)</td>
</tr>
</tbody>
</table>

We preformed two 2x2 factorial ANOVAs, with pain information and (dis)confirmation as between-group factors and either positive affect score and negative affect score as dependent variable. These analyse revealed no significant main effects or interaction effect. All F values were smaller than 3.71, and all p values were lager then .05.

A 2x2 factorial ANOVA, with pain information and (dis)confirmation as between-group factors and certainty of expectations as dependent variable, showed a main effect of (dis)confirmation, $F(1,99)=25.32$, $p<.05$. The confirmed group was more certain of their expectation (M=6.57, SD=2.87) than the group receiving disconfirming
information (M=2.98, SD=2.68). There was no main effect of pain information on certainty between the positive informed group (M=6.00, SD=2.84) and the negative informed group (M=3.49, SD=3.27), $F(1.99)=1.92, p>.05$. Furthermore there was no significant interaction effect between pain information and (dis)confirmation, $F(1.99)=3.11, p>0.05$. This shows that the participants who were confirmed in their expectation was more certain of their expectation than those who were disconfirmed.

**Retrospective ratings about the fictitious information, after pain test**

The mean value of the perceived pleasantness, threat and comfort, related to the information given about previous participants pain perception, is presented in table 4. The pleasant variable was converted from -5 to 5 into 0 to 10.

Table 4. Ratings after the cold pressor test regarding the information given about previous participants pain perception.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Confirmed Negative</th>
<th>Confirmed Positive</th>
<th>Disconfirmed Negative</th>
<th>Disconfirmed Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant (SD)</td>
<td>5.50 (2.11)</td>
<td>7.26 (2.01)</td>
<td>4.21 (1.51)</td>
<td>6.54 (2.03)</td>
</tr>
<tr>
<td>Threatening (SD)</td>
<td>3.67 (2.64)</td>
<td>1.18 (1.92)</td>
<td>4.31 (2.55)</td>
<td>2.15 (2.19)</td>
</tr>
<tr>
<td>Comforting (SD)</td>
<td>4.25 (3.11)</td>
<td>7.33 (2.14)</td>
<td>2.72 (1.75)</td>
<td>5.54 (2.99)</td>
</tr>
</tbody>
</table>

Three separate 2x2 factorial ANOVAs with pain information and (dis)confirmation as between-group factors were conducted to see whether the four groups differed in perceived pleasantness, threat and comfort of the manipulating message.

The 2x2 factorial ANOVA with pleasantness as dependent variable showed a main effect of (dis)confirmation $F(1.99)=5.61, p<0.5$: Participants who were confirmed perceived the message as more pleasant (M=6.84, SD=2.15) than participants who were disconfirmed (M=4.79, SD=1.92). There was also a main effect of pain information, $F(1.99)=23.16, p<.05$: The positive message (previous participants perceived low pain)
was perceived as more pleasant (M=7.08, SD=2.02) than the negative message (previous participants perceived high pain) (M=4.51, SD=1.74). Furthermore there was no significant interaction effect between pain information and (dis)confirmation \( F(1,99)=0.46, p>0.05 \). For the participant who received a positive information the message was perceived as more pleasant than for those who received the negative message independent of whether they were confirmed or disconfirmed. The participants who received confirming information perceived the message as more pleasant than those who were disconfirmed, independent of whether the information was positive or negative.

The 2x2 factorial ANOVA with comfort as dependent variable, showed a main effect of (dis)confirmation, \( F(1.99)=10.28, p<0.05 \): Participants who were confirmed perceived the message as more comforting (M=6.61, SD=2.71) than participants who were disconfirmed (M=3.42, SD=2.43). There was also a main effect of pain information \( F(1.99)=32.36, p<0.05 \): The positive message (previous participants perceived low pain) was perceived as more comforting (M=6.88, SD=2.48) than the negative message (previous participants perceived high pain) (M=3.08, SD=2.21). However there was no significant interaction effect between pain information and (dis)confirmation \( F(1,99)=0.06, p>0.05 \). For the participant who received a positive information the message was perceived as more comforting than for those who received the negative message independent of whether they were confirmed or disconfirmed. The participants who received confirming information perceived the message as more comforting than those who were disconfirmed, independent of whether the information was positive or negative.

The 2x2 factorial ANOVA, with threat as dependent variable, showed a main effect of pain information, \( F(1.99)=19.37, p<0.05 \): The negative message (previous
participants perceived high pain) was perceived as more threatening (M=4.16, SD=2.56) than the positive message (previous participants perceived low pain) was (M=1.42, SD=2.01). There was no significant main effect of (dis)confirmation F(1.99)=2.35, p>.05, between the confirmed group (M=1.76, SD=2.34) and the disconfirmed group (M=3.77, SD=2.62). Furthermore there was no significant interaction effect between pain information and (dis)confirmation F(1.99)=0.10, p>0.05. This shows that the participants who received negative information perceived the message as more threatening than those who received the positive message.

Finally a chi-square test was performed to see if there was an association between the four groups and whether they changed their pain expectation after receiving the fictitious information. The chi square showed a significant overall association of pain information and (dis)confirmation on change of expectation $X^2 (1) = 27.9$, p< .05. Out of the people who did change their expectations, the group receiving negative disconfirming information was the group who change their expectation most (76.5%). Out of the people who did not change their expectations, the group receiving positive confirming information was the group were most participants kept their initial expectation (75.0%).

**Discussion**

The purpose of the study was to investigate if pain perception is influenced by; positive/negative information about others pain experience and confirming/disconfirming information of pain-specific expectation. Previous research has shown that negative information increase the subjective perception of pain (Atlas&Wager, 2012; Liberman, 1962). In this study we could confirm this finding. Furthermore precious research have shown that a cognitive conflict elicit aversive signals (Dreisbach & Fischer, 2012). In this study we explored whether disconfirming
information do influence the subjective perception of pain if a cognitive conflict were perceived. This was not found in our result.

Our first hypothesis was supported; the group receiving positive information (others perceived this test as low painful) perceived less pain during the cold pressor test than those receiving negative information (others perceived this test as high painful). As placebo studies have shown, the perception of pain decreased with positive information while negative information increased the perception of pain (Atlas & Wager, 2012; Liberman, 1962). The result confirms that our social surroundings and more specifically communication by others have an effect on our pain perception (Craig, 2009; Gatzounis, Schrooten, Crombez, & Vlaeyen, 2012; Hadjistavropoulos, 2011). A reason for this result could be that the positive message was perceived as a reassuring message, that reduces concerns and give higher satisfaction (Pincus, et al., 2013), and therefore result in decreased pain intensity. That the message was perceived as reassuring is implied by the three retrospective measures. The result showed that the participants who received positive information perceived the message as more pleasant, more comforting and less threatening then those receiving the negative message.

Our second hypothesis was not supported since overall there was no significant difference between the disconfirmation and confirmation group in the perception of pain. However there was a significant interaction effect, suggesting that the effect of positive versus negative information on pain perception depends on whether this information was confirming or disconfirming the initial pain expectation. Our findings suggest that participants who initially expected high pain and who were confirmed in this expectation perceived more pain than those whose high pain expectation were disconfirmed and also more than those who initially expected low pain (whether or not
this expectation was disconfirmed). So, as expected the effect of information massages depends on whether they confirm or disconfirm initial pain expectations.

However the pattern of the result was not totally in line with our third hypothesis; that the negatively disconfirmed group, if a cognitive conflict were perceived, would experience the most pain. On the other hand the result indicates that the disconfirmed group did not perceive a cognitive conflict. Cognitive conflict is reflected in increased negative affect (Dreisbach & Fischer, 2012) and increased uncertainty (or lowered certainty) about expectations (Pollock, Grime, Baker & Mantala, 2004). Our disconfirmed groups were significantly lower in certainty than the confirmed groups (independent of whether the information given was positive or negative) indicating a cognitive conflict. Whether uncertainty of a pain specific expectation generates more or less pain than certainty of an expectation is something that has been under discussion in previous research (Yoshida, Seymour, Koltzenburg & Dolan, 2013). In our result we found that, even though the disconfirmation did create uncertainty, the uncertainty did not increase the pain as hypothesized. Instead certainty of a high pain expectation increased the pain intensity. This could explain the significant difference between positive and negative information when confirmed. A confirmation by others in a high expectation increased certainty of expectation and pain intensity. As mentioned a cognitive conflict is also characterised by negative affects. Although the disconfirmed group was more uncertain, there was no significant group difference between negative and positive emotions, due to getting the fictitious information, indicating that no cognitive conflict was perceived.

Furthermore an interaction effect was not found in all conditions. When disconfirmed it did not seem to matter whether getting positive or negative information. And in contrast to what we expected, the impact of getting positive information (others
perceived test as low painful) did not depend on whether this information was in line or not with initial pain expectations.

We admit that our study do have a few limitations that could have influenced our result. First, verbal ratings of pain intensity during the cold pressor test might have had an impact on the honesty of the ratings. This mostly concerns the group receiving positive information. Hearing that others perceived the test as low painful might create a desirability of not being weaker than the average. To minimize the impact of the experiment leader, the participant was alone in the room while answering the questions and performing the cold pressor test. The participant was also informed that all answers were treated confidential throughout the whole process. There was a discussion about the participant giving written pain ratings instead of verbal ratings. But to avoid creating a distraction, which could have had an effect the pain perception, this was not done. Verbal ratings are also a frequently used way to rate pain in cold pressor test experiments (Ferreira-Valente, Pais-Ribeiro & Jensen, 2011). Second, we need to keep in mind that retrospective questions were used to measure cognitive conflict. The cold pressor test could have influenced the participant’s feelings and memory of the fictitious information. But letting the participants answer how they felt right after they received information was not possible, since this could have ruined the purpose of the test and the manipulation would not have been believable. For further research it would be interesting to measure the perceived cognitive conflict right after receiving fictitious information.

Third, the cold pressor test is one of the most widely used experimental pain tests (Mitchell, MacDonald & Brodie, 2004). In cold pressor test it is most common to standardize the skin-temperature right before performing the test (Von Baeyer, Piira, Chambers, Trapanotto & Zeltzer, 2005). We decided to standardize the skin-
temperature before the participants answered the first expectations questions instead. This was to make sure that the room temperature water did not change the participant’s expectation before immersing their hand in the cold pressor test. Therefore, although unlikely, we cannot exclude that the participants might have had a somewhat different skin-temperature at the start of the cold pressor test. Fourth, even though a pilot was conducted to make sure that the groups expecting high and low pain would be roughly equal, the group size differences was bigger than the pilot indicated. Groups with different sizes also differed in variance in pain ratings and so the assumption of equality of variance was not met (Levene’s test). The use of separate independent t-test (assuming that equality of variance was not met) increase the chance of making a type I error, indicating that there is a significant difference when there is actually none. To see whether the groups would be more equally distribute between high and low expectation, it would be interesting to conduct this study again, but this time with more intimidating pain stimulation.

Creating a cognitive conflict is very challenging in the laboratory and therefore we still don’t know if a cognitive conflict enhances the pain intensity. For further research it would be interesting to create a stronger manipulation, e.g. by giving two or more incongruent messages, to see whether this could generate a cognitive conflict. For this study it was considered, but due to this being a first attempt to explore disconfirming information creating a cognitive conflict and pain we decided to only use one manipulation.

Strength of the study is the cold pressor test. It is a valid and reliable instrument, often used in pain studies (Edens & Gil, 1995). Developing the study we stayed as close as possible to the standard procedure to make sure the result would be comparable to other studies. The test was performed in a laboratory and we could therefore control for
extraneous variable (such as distractions and social pressure) that otherwise could have influence our result. Another strength is that the participants were randomly assigned to the different groups and individual differences could therefore not have influenced the result. Also the design of the study, and more specifically the fictitious information, seemed to be perceived as believable. This was indicated since the average of the disconfirmed participants changed their expectation after receiving information. Moreover for being a first attempt to explore disconfirming information and pain, the sample size is relatively good due to the time limits.

This study confirms that our expectations does influence our perception of pain, which can be found in many studies (Atlas & Wager, 2012; Bingel et al., 2011; Koyama et al., 2005; Rose et al. 2012; 2011). Also that certainty of an expectation increase pain, which is in line with previous studies as well (Brown, Seymour, Boyle, El-Deredy & Jones, 2008).

**Conclusion**

What we can see in this study is that positive and negative information is a stronger predictor of pain then if the message is confirming or disconfirming a first expectation. So what information should the dentist have told the patience to make the appointment as pleasant as possible? If the patient expected the appointment to be low painful, he should give her positive, confirming information. If the patient instead had expected the procedure to be high painful the dentist should still give her positive information even though it would be disconfirming. So with the benefit of hindsight, the dentist did actually approached the painful appointment in the right way from the beginning, “*My patients usually don’t think this hurts*.”
Refrences


Appendix 1

Demographics and exclusion criteria 1/2

Please, complete the following general checklist:

Birth date? ______________________

Tick in the option that suits you the best:

Gender? Female ☐ Male ☐

Dominant hand? Your dominant hand is the hand you prefer to perform fine and gross motor tasks, such as writing, cutting or catching and throwing a ball.

    Left ☐ Right ☐ No preference at all ☐

How tired are you at the moment? 0=not tired at all; 10=very tired

0 1 2 3 4 5 6 7 8 9 10

Tick in the corresponding box if:

☐ You are not a (under)graduate student
☐ You have prior experience with a cold water test
☐ You are younger than 18 years old or older than 30 years old
☐ You are not fluent in Swedish
☐ You have an open cut, sore or big scar on the other hand than your dominant hand
☐ You have a fracture of the other hand/arm than your dominant hand/arm
☐ You have a history of seizures (epilepsy)
☐ You have a history of frostbite (= injury to fingers, nose, toes… caused by exposure to extreme cold)
☐ You have a history of very high blood pressure or cardiovascular disorder
☐ You have a history of Raynaud’s phenomenon (= excessively reduced blood flow to fingers or some other areas of the body in response to cold or emotional stress)
☐ You have chronic pain complaints
You had a recent (physical) accident or surgery

>>> CONTINUE ON NEXT PAGE.

Demographics and exclusion criteria’s 2/2

- You have acute pain complaints at the moment, such as a headache, belly pain, or very sore throat
- You have used strong medication or a pain killer during the last 24 hours
- You have used drugs or drank alcohol during the last 24 hours If yes, what drugs/alcohol and how much? ________________________________
  ________________________________
  _______________________________________
- You drank coffee during the last hour. If yes, how much? ______________
  _______________________________________
Demografi and exkluderingskriterier 1/2

Var god, fyll i följande information:

Födelsedatum? ____________________________

Markera det alternativ som passar dig bäst:
Kön? Kvinna ☐ Man ☐

Dominant hand? Din dominanta hand är den du föredrar att använda när du utför fin och grovmotoriska rörelser, exempelvis skrivning, klippning eller kasta och fånga boll.
Vänster ☐ Höger ☐ Inga preferenser alls ☐

Hur trött är du för tillfället? 0=inte trött alls; 10=väldigt trött
0 1 2 3 4 5 6 7 8 9 10

Markera rutan om:
☐ Du inte är en student
☐ Du har tidigare erfarenhet av kallvattentestet
☐ Du är yngre än 18 år eller äldre än 30 år
☐ Du inte är flytande i Svenska
☐ Du har ett öppet sår, skärsår eller ett stort ärr på din icke-dominanta hand
☐ Du har en hand- eller armfraktur på din icke-dominanta hand
☐ Du har en bakgrund av anfall (epilepsi)
☐ Du har en bakgrund av frostskador (=skador i fingrar, näsa, tår… orsakat av extrem kyla)
☐ Du har en bakgrund av väldigt högt blodtryck eller hjärt- och kärlsjukdom
☐ Du har en bakgrund av Raynaud’s fenomen (=extremt minskad blodtillförsel till fingrar eller andra delar av kroppen, vid kalla temperaturer eller emotionell stress.)
☐ Du har kronisk smärtproblematik.
☐ Du har nyligen erfarit (fysisk) olycka eller operation

>>>>>> FORTSÄTT TILL NÄSTA SIDA.
Demografi and exkluderingskriterier 2/2

☐ Du har just nu akut smärta, så som huvudvärk, magont, eller väldigt ont i halsen
☐ Du har använt stark medicin eller smärtstillande under de senaste 24 timmarna.
☐ Du har använt droger eller druckit alkohol under de senaste 24 timmarna. Om ja vad för droger/alkohol och hur mycket.________________________
☐ Du har druckit kaffe inom den senaste timmen? Om ja, hur mycket? ________

**************
Appendix 2
INFORMED CONSENT
Study on evaluation of cold water test in Sweden, Örebro University.

Participant.
I am informed about the study and I have read the written information (GeneralInfo_CWT1115.doc). I have had the opportunity to ask questions and I have considered my participation in this study. I have been informed about the right to interrupt this study without any consequences.

I agree on being a participant in this study.

Name:

Age:

Signature Date

____________________________________________

Signed by experiment leader. I state that the participant has been both written and orally informed about the study and the experiment.

Name:

Operation:

Signature Date

____________________________________________
INFORMERAT SAMTYCKE
_Utvärderande studie av kallvatten-testet i Sverige, Örebro Universitet._

Deltagare.
Jag är informerad om studien och jag har läst den skrivna informationen (generellInfo_KVT1115.doc). Jag har haft möjligheten att ställa frågor och jag har övervägt mitt deltagande i studien. Jag har blivit informerad om mina rättigheter att närsomhelst avbryta studien utan vidare konsekvens.

Jag ger här med mitt samtycke till att delta i studien.

Namn: ____________________________

Ålder: ____________________________

Signatur ____________________________ Datum ____________

Signeras av experimentledare. Jag intygar att deltagare har fått både skriven och muntlig information om studien och experiment.

Namn: ____________________________

Verksamhet: ____________________________

Signatur ____________________________ Datum ____________
Appendix 3  
Questions before Cold pressor test English version

Question 1: Fear
1.1. Are you fearful to perform the cold water test? Yes vs no
1.2. How fearful are you to perform the cold water test?

<table>
<thead>
<tr>
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</table>

Question 2: Pain-intensity expectation
Previous research shows that there is considerable variation among participants in their expectations about the cold water test:

2.1. Do you think the cold water test will be low painful or high painful? Low vs high
2.2. How painful do you think the cold water test will be?

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<thead>
<tr>
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<th>1</th>
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</tbody>
</table>

Question 3: Subjective confidence in pain-intensity expectation
Q3.1. Are you certain of this expectation? Yes vs no
Q3.2. How certain are you of this expectation?

<table>
<thead>
<tr>
<th></th>
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</table>

0=not fearful at all  10=very fearful
0=not painful at all  10=very painful
0=not certain at all  10=very certain
Frågor innan kallvattentestet

Fråga 1: Rädsla
Q1.1. Är du rädd för att utföra kallvattentestet? Ja eller Nej
Q1.2. Hur rädd är du för att utföra kallvattentestet?
0 = inte alls rädd 10 = väldigt rädd

Fråga 2: Förväntan på smärtintensitet
Tidigare forskning visar att det finns en betydlig variation bland deltagarna i deras förväntan inför kallvattentestet:
Q2.1. Tror du att du kommer uppleva låg eller hög smärta under kallvattentestet? Låg eller hög?
Q2.2. Hur smärtsamt tror du att kallvattentestet kommer att vara?
0 = inte smärtsamt alls 10 = väldigt smärtsamt

Fråga 3. Säkerheten på den egna smärtintensitetsförväntningen
Q3.1. Är du säker på denna förväntning? Ja eller Nej
Q3.2. Hur säker är du på denna förväntning?
0= inte säker alls, 10= väldigt säker
Appendix 4

**Question during the cold pressor test**

Q1.1 How much pain do you experience now?

0=no pain at all 10=very much pain

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</table>

**Frågor under kallvatentestet**

Q1.1 Hur mycket smärta upplever du nu?

0=no pain at all 10=very much pain

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Appendix 5
Questions after cold pressor test

*Incongruent conditions:* We would like you to answer the following questions about how you felt just before the cold water test. Just before the cold water test you were told that previous participants (similar age, same gender) found the test to be LOW (HIGH) painful, *whereas* you first expected it to be HIGH (LOW) painful.

*Congruent conditions:* We would like you to answer the following questions about how you felt just before the cold water test. Just before the cold water test you were told that previous participants (similar age, same gender) found the test *indeed* to be LOW (HIGH) painful, just like you first expected.

How did this (mis)match between others’ pain experience and your first expectation made you feel? Indicate for each group of words the extent to which you felt in that way.

1. Interested, concentrated, alert
2. Fearful, scared, afraid
3. Anxious, tense, nervous
4. Angry, irritated, mad
5. Ashamed, embarrassed
6. Joyful, amused, happy
7. Sad, downhearted, blue
8. Satisfied, pleased
9. Surprised, amazed, astonished
10. Calm, serene, relaxed

When you were told that previous participants found the test to be LOW (HIGH) painful:

Q2.1. Did you change your expectation about how painful the cold water test would be? Yes vs no

Q2.2. How painful did you think the cold water test would be? 11-point numerical Likert scale

0=not painful at all 10=very painful

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Q2.3. How certain did you become in your expectation about how painful the cold water test would be? 11-point numerical Likert scale (0=not certain at all; 10=very certain)

What did you think of the message about others’ pain experience?

Q3.1. Plesant

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-5= very Unpleasant 5=very pleasant

Q3.2. Threatening*

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0=not threatening at all 10= very threatening

Q3.3.

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0=not comforting at all 10= very comforting

* worrysome, discomforting, disturbing
Frågor efter kallvattentestet


Congruent condition: Vi skulle vilja att du svarar på följande frågor om hur du kände dig precis innan kallvattentestet. Precis innan kallvattentestet fick du höra att tidigare kvinnliga (manliga) deltagare i din ålder upplevde hög/låg smärta under testet, precis som du själv förväntade dig.

Q1.1 Hur fick denna (mis)match mellan andras smärtupplevelse och dina egna första förväntningar dig att känna? Ange för varje grupp av ord i vilken utsträckning du kände på det sättet. (1= inte alls; 4=måttligt; 7= väldigt intensivt)

1. Intresserad, koncentrerad, uppmärksam
2. Ängslig, skrämd, rädd
3. Orolig, spänd, nervös
4. Arg, irriterad, ilsken
5. Skamsen, generad
6. Upprymd, roada, glad
7. Ledsen, nedstämd, dyster
8. Tillfredsställd, nöjd
9. Förvånad, häpen, överraskad
10. Lugn, rofylld, avslappnad

När du fick höra att tidigare deltagare upplevde låg/hög smärta vid testet:

Q2.1. Ändrade du din förväntning om hur smärtsamt kallvattentestet skulle vara? Ja eller Nej

Q2.2. Hur smärtsamt trodde du att kallvattentestet skulle vara?

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Q2.3. Hur säker blev du på din förväntning om hur smärtsamt kallvattentestet skulle vara?
Vad tyckte du om informationen om andras smärtupplevelse?

Q3.1 Behagligt
-5= väldigt obehagligt 5= väldigt behagligt

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Q3.2 Oroväckande
0= inte alls oroväckande 10=väldigt oroväckande

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Q3.3 Lugnande
0= inte alls lugnande 10=väldigt lugnande

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