

No pain no gain? Pursuing a competing goal inhibits avoidance behaviour

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Abstract

This experiment investigated pain-related avoidance behaviour in a context of competing goals. Participants ($N = 56$) were presented trials of two different tasks of which one could produce pain. They were free to decide whether or not to perform trials of these tasks. In half of the participants a competing goal was activated by instructing them that they would receive a monetary reward corresponding to the number of pain task trials actually performed (competition group). In the other half of the participants no competing goal was installed (control group). Results showed that the competition group showed less frequent avoidance behaviour than the control group. Furthermore, the association between pain-related avoidance behaviour and fear of pain was smaller in the competition group than in the control group. The findings indicate that the emergence of pain-related avoidance behaviour depends upon the motivational context, and that the association between pain-related fear and avoidance is not stable. This study has implications for our understanding of disability, and points to the need to consider avoidance behaviour within a broad context of multiple, often competing, goals.

Keywords: pain-avoidance; fear; coping; goals; motivation; experimental pain

Introduction

Disability, or the extent to which pain interferes with the accomplishment of daily life tasks, is the key reason of patients to consult health care providers, and is associated with high costs when pain becomes chronic [8,11]. Patients' beliefs about their pain have been argued to play an essential role in maintaining disability [19,23,45,47]. The fear-avoidance model states that catastrophic beliefs about pain, i.e., interpretation of pain as a sign of serious injury or pathology, lead to excessive fear of pain/injury that gradually extends to avoidance of activities that are presumed to worsen the pain [44]. Although this model has been empirically validated by both clinical and experimental findings [18,21,35], some challenges remain. First, several studies have failed to demonstrate a significant association between fearful pain appraisal and actual avoidance behaviour [6,12]. Second, not all chronic pain patients display the typical fear-avoidance pattern [45]. Some patients even report task persistence and suppression of pain-related thoughts, although this evidence is still preliminary [13,27].

One possible reason for these incongruent findings is that fear-avoidance models consider avoidance as a relatively stable behaviour pattern [13]. Largely neglected, however, is that avoiding pain is often only one goal in a dynamic environment with concomitant, competing goals [15,38,46]. While patients may often attempt avoiding pain by limiting physical activity, other goals related to work, household, or social life rather require persistence of activity. We therefore propose that a more dynamic view on avoidance behaviour, taking into account the motivational context, is necessary to further our understanding of disability [4]. For this purpose, adopting theories of goal selection, multiple goal management, and decision making may be a fruitful avenue. Such theories argue that choices (e.g.,

avoiding versus persisting a pain-evoking activity) may have both outcome benefits (e.g., preventing pain increase) and costs (e.g., loss of social contact), and that the value and probability of success of the various options influence decisions [7,9,14,26]. Of particular interest is the idea of “goal shielding”, which refers to the mechanism that commitment to a focal goal inhibits the accessibility of conflicting goals and protects behavior against habitual interferences [3,10,20,30,31]. Consequently, and in line with recent motivational views on pain behavior, the goal of pain-avoidance may be inhibited by the pursuit of a competing, more valuable goal (e.g., preparing dinner for friends) [4,25]. When a valuable goal is “shielded” from conflicting interferences such as pain, fear of pain is less likely to trigger avoidance behavior.

Here we experimentally investigate the effect of competing goals on pain-related avoidance behaviour. Participants performed a pain-evoking task, but could avoid pain by not responding to trials. In the competition group, a competing goal was activated by monetary rewarding the number of pain-task trials actually performed. In the control group no competing goal was induced. We hypothesized (1) avoidance to be less pronounced in the competition than in the control group, and (2) avoidance to be less associated with pain-related fear in the competition than in the control group.

Methods

Participants

Fifty-six undergraduate psychology students (26 males and 30 females; mean age = 18.7 years; all white Caucasian) from Ghent University participated in order to fulfil course requirements. The protocol of the experiment was approved by the

ethical committee of the Faculty of Psychology and Educational Sciences of Ghent University. All participants gave informed consent and were free to terminate the experiment at any time. Each person had normal or corrected-to-normal eyesight. Experimental duration was approximately 30 minutes.

Apparatus and experimental paradigm

The experiment was programmed and presented by the INQUISIT Millisecond software package. INQUISIT measures response times with millisecond accuracy [5]. Trials from two different identification tasks were presented in a random order. In the “number” task, a digit (“4” or “6”) was presented which participants had to identify using the “4” and “6” keys on a keyboard. In the “letter” task, participants had to identify a letter (“K” or “M”) using the “K” and “M” keys on a keyboard. Responses in both tasks were given with the dominant hand. Targets were presented for 1000ms. Each trial started with a cue (1000ms) announcing which task would be presented (word “number” or “letter”). An equal number of trials from both tasks was presented.

Participants were informed that the execution of one of the tasks (pain task; counterbalanced across participants) would be followed by a pain stimulus in half of the trials. Performance of the other task (neutral task) would never be followed by a pain stimulus. They were further informed that they were free to decide whether or not they would perform trials of these tasks, and that by not executing the pain task they would avoid receiving the painful stimulus. The neutral task was included as a check that avoidance behaviour was only related to the pain task.

Pain stimuli were low-intense electrocutaneous stimulus, delivered by a constant current stimulator (Digitimer DS5, Hydeway, UK). Electrocutaneous stimuli consisted of a 500ms pulse with a frequency of 200 Hz, and were delivered at the external side of the wrist of the non-dominant hand by two lubricated Fukuda

standard Ag/AgCl electrodes (1 cm diameter). Intensity of the electrocutaneous stimulus was 1.00 mA. Previous studies have demonstrated that this intensity is easy to tolerate, and is perceived as moderately aversive and threatening [37,40].

Experimental manipulation

Half of the participants were told that performing the pain task would not only result in the potential administration of a painful stimulus but also in a financial reward (competition group). In half of the executed pain task trials (maximal latency of 2000ms), the response was followed by a painful stimulus and by an on-screen message that “5 points were won”. Participants were informed that the financial reward would be calculated from the total number of points collected, and that they would be rewarded with a maximum of 5 euro on completion of the experiment. In the other half of the participants, no information was given about a financial reward, and performing the pain-evoking task did not result in a financial reward (control group).

Procedure

Before the experiment participants were informed about the use of electrocutaneous stimuli. They were told that “most people find this kind of stimulation aversive” [37]. Next, participants gave their informed consent. Then, a pair of electrodes was attached to the wrist of the non-dominant hand. The skin at the electrode sites was first abraded with a peeling cream (Nihon Kohden) in order to reduce skin resistance. To become familiar with the electrocutaneous stimulus, each participant was first presented with a low intensity stimulus of 0.50 mA, and then with a stimulus of 1.00 mA, which was further used during the experiment. They were asked to rate how aversive the stimulus was on a scale from 0 to 10, with 0 meaning “not aversive at all”, and 10 meaning “very aversive” (pre-experiment aversiveness rating).

Next participants read the task instructions on a monitor, and performed a 16-trial practice phase without painful stimulation (8 letter task trials and 8 number task trials; random presentation). When the task was clear, participants performed a baseline phase of 32 trials, again without painful stimulation (16 letter task trials and 16 number task trials; random presentation). Then, participants performed the experiment phase, which consisted of 64 trials (32 letter task trials and 32 number task trials; random presentation). One of the tasks was the pain task and the other was the neutral task (counterbalanced across participants). Upon termination of the experiment, a number of self-report measures were completed. As a measure of goal value, participants rated how important they found it to perform the pain-evoking task and the neutral task on a 10-point numerical rating scale (0 = not at all; 10; very). Participants also rated unpleasantness of the electrocutaneous stimulus on a 11-point numerical rating scale (-5 = very unpleasant; +5 = very pleasant). Furthermore, they rated painfulness of the electrocutaneous stimulus and how fearful they were of the electrocutaneous stimulus during the experiment on 10-point numerical rating scales (0 = not at all; 10; very). Finally, participants completed the Dutch version of the Pain Catastrophizing Scale (PCS [32]), a 13-item scale to assess catastrophic thoughts about pain in both non-clinical and clinical populations. Participants are asked to reflect on past painful experiences and to indicate the degree to which they experienced each of the 13 thoughts or feelings during pain (e.g. 'I become afraid that the pain may get worse') on a 5-point scale from 0 (not at all) to 4 (all the time). The Dutch version of the PCS has been shown to be valid and reliable in both healthy populations and chronic pain patients [36]. Cronbach's alpha of the PCS-DV in this study was 0.86.

Results

Sample characteristics and self-report data

Characteristics of the participants are reported in Table 1. There were no significant baseline differences between groups in age ($F < 1$), sex distribution ($\chi^2(1) = 0.02$, ns), PCS ($F < 1$), and pre-experiment aversiveness ratings of the electrocutaneous stimulus ($F < 1$). Furthermore, there were no significant differences in post-experiment ratings of unpleasantness of electrocutaneous stimulus, painfulness of electrocutaneous stimulus, and fear of the electrocutaneous stimulus (all $F_s < 1$). The experimental manipulation of goal competition was successful. An ANOVA revealed a significant difference between groups on goal value of the pain task ($F(1,53) = 4.42$, $p < .05$), which was higher in the competition group than in the control group. Furthermore, there was also a group difference on goal value of the neutral task ($F(1,53) = 5.57$, $p < .05$), which was significantly lower in the goal competition group than in the control group. In addition, paired-samples t -tests showed that goal value was higher for the pain task than for the neutral task in the competition group ($t(27) = 2.38$, $p < .05$), whereas the reverse was found in the control group ($t(26) = 2.56$, $p < .05$).

INSERT TABLE 1

Decision behaviour

Inspection of response behaviour on the neutral task in the experiment phase indicated that one participant performed none of the neutral task trials (whereas all other participants performed all of the neutral task trials). This may suggest misunderstanding of instructions or extreme, generalized, avoidance behaviour. This

participant was therefore considered an outlier and excluded from further analyses. As an index of avoidance behaviour, we investigated the number of non-executed pain-task trials in the experiment phase. This variable was, however, not normally distributed (Kolmogorov-Smirnov $Z = 2.38$, $p < .001$), as a result of which the use of parametric statistics was not justified. Therefore, in order to compare the number of non-executed pain-task trials between groups (see Table 1 for means), we computed an Independent-Samples Mann-Whitney U-Test. This showed that the number of avoided pain-task trials was significantly lower in the competition group than in the control group ($U = 531$, $p = .004$).

Associations between decision behaviour and self-reports

We examined the association between fear and avoidance behaviour, and tested whether this association was different depending upon motivational context. For this purpose we calculated (non-parametric) Spearman's *Rho* correlations between the number of avoided pain task trials and both self-reported fear and catastrophic thinking about pain. Overall we found that more avoidance behaviour was associated with higher fear of the pain stimulus ($r = .42$, $p < .01$) but not with more catastrophic thinking about pain ($r = .03$, ns).

Next we tested whether correlations were different depending upon motivational context. Therefore, we calculated Spearman's *Rho* correlations separately for the competition group and the control group. Differences between groups were tested by means of Fisher *Z* transformations. We found that higher fear was associated with more avoidance behaviour in the control group ($r = .67$, $p < .001$) but not in the competition group ($r = .23$, ns) (for scatter plot of associations, see Figure 1). The association between fear and avoidance behaviour was significantly smaller in the competition group than in the control group (Fisher $Z = 1.98$, $p < .05$).

The correlation between catastrophic thinking about pain and avoidance behaviour was not significant in both the competition group ($r = -.23$, ns) and control group ($r = .17$, ns), and there was no significant difference in correlation between both groups (Fisher $Z = 1.42$, ns).

INSERT FIGURE 1

Discussion

In this experiment pain-related avoidance behaviour was investigated in a context of competing demands. Participants performed two tasks of which one evoked pain. They were instructed that they could avoid pain by not performing trials of the pain task, inducing the pain-avoidance goal. However, in half of the sample a competing goal was related to this task by monetary rewarding execution of pain-task trials (competition group). In the other half no such competing goal was installed (control group). The results support our hypotheses. First, the competition group showed less frequent avoidance behaviour than the control group, as reflected by a lower rate of non-executed pain task trials. Second, the relation between avoidance behaviour and fear of the pain stimulus depended upon the motivational context. Higher fear was less strongly associated with increased pain avoidance in the competition group than in the control group. However, no significant associations between catastrophic thinking about pain and avoidance behaviour were found.

Our findings have implications for current views on disability and pain-related avoidance. This study shows that avoidance behaviour depends, at least to some extent, upon the motivational context. We found that avoidance of pain was inhibited when a competing task-related goal (i.e., earning money) was activated. Current

models of disability [13,44] consider pain-related avoidance as a relatively stable behaviour pattern. The present findings suggest that such view might be too narrow, and that pain behaviour should be considered within a dynamic environment of concomitant, often competing, goals [15,38,46]. Indeed, when patients avoid activities to prevent an increase in pain intensity, this comes often with a cost of the pursuit of personal goals in domains of work, social life, family, recreation, etc... It is likely that in some situations, patients will choose to perform valuable activities despite an (expected) increase in pain. One would expect then that, in a context of competing goals, fear of pain is only one factor influencing the decision to avoid or persist. Our data illustrate this point. When only the pain avoidance goal was activated, avoidance behaviour was strongly associated with how fearful participants were of the pain stimulus. This is in line with experimental and clinical evidence for fear-avoidance models [21,44]. However, when a competing goal was activated, the association between avoidance behaviour with fear of the pain stimulus was significantly lower. While such finding is difficult to explain from fear-avoidance models, theories of goal striving and decision making may increase our understanding. More specifically, when making behavioural decisions, the value and probability of success of the various options influence choice [7,9,14]. Furthermore, it has been proposed that engagement to a goal (i.e., performing the task to increase monetary reward) leads to inhibition of conflicting goals (i.e., avoiding the task to prevent pain) [10,20,25]. This view can be easily applied to pain-related avoidance behavior observed in the present study: although fear of the pain stimulus was equally high in both groups, avoidance behavior was reduced when a competing goal was pursued. This finding indicates that avoidance of tasks that are expected to evoke pain is not a stable behavioral pattern or individual disposition. The

motivational context of the task might play an essential role in decision behavior [15,26,34,38,46].

The findings of the present study can also be explained in terms of “goal shielding”. This refers to the mechanism that commitment to a valuable goal inhibits the accessibility of conflicting goals and protects task behavior against habitual interferences and irrelevant distracters [3,10,20,30,31]. Our self-report data show that financially rewarding performance of the pain task significantly increased the value of the goal to perform this task. Consequently, this stronger commitment to the task inhibited the goal to avoid pain, and attenuated interference by distracting information, i.e., fear of pain [22,39]. In line with this reasoning, it has been found that during a cold-pressor task, financially rewarding a tone-detection task increased engagement to that task (reflected by both self-reports and faster reaction times) and reduced attention to pain [41]. In such motivational context, it is likely that pain or fear has less impact upon avoidance behavior [4]. Our data, although correlational, are in line with this idea: the association between fear and avoidance was less pronounced in the competition group than in the control group.

A number of issues with regard to this study deserve further discussion. First, one might argue that the ecological validity of our goal manipulation is limited. Participants were undergraduate students, and providing a financial reward for performing a task to increase the goal value of the task may be less effective in other samples. However, it is a simple way to increase motivation and task engagement in laboratory research [24], and has been successfully used previously in pain studies [34,41,42]. Naturally, also other approaches might be useful to influence pain-related task behavior, such as the experimental manipulation of stop rules [16]. In clinical populations, the manipulation of motivational characteristics of tasks is less evident.

In order to investigate the role of such characteristics on behavioral decisions and pain behavior, a careful assessment of goal priorities is required, for instance using diary methods [1] or specifically designed goal pursuit questionnaires [17]. A second issue concerns the finding that avoidance behaviour was associated with fear of pain but not with catastrophic thinking about pain. This might be due to the fact that fear of pain was measured with a single item specific to the experimental setup.

Catastrophic thinking, on the contrary, was measured with a more general questionnaire, i.e., the PCS [32]. Although catastrophic thinking has been shown to be associated with behavioural responses to pain in both clinical [33] and healthy populations [37], the relative lack of specificity of the PCS may have obscured its association with avoidance behaviour specific to the experimental setup in this study.

A third issue is that, although participants were free to avoid the pain-evoking task, the number of non-executed pain task trials was overall low, even in the control condition. Apparently, our participants were highly motivated to perform all tasks. It might be that the pain stimuli administered were only moderately painful and threatening, as seen in the self-report data. More research is needed to investigate whether a competing goal is capable of overruling avoidance behaviour when pain is more intense and fear of pain is more pronounced, as is the case in patients with chronic pain. In such situation, the goal to control pain and prevent potential bodily damage might be strongly prioritized [39], and the value of competing goals will need to be substantially increased in order to overrule this pain avoidance goal [26,34].

Fourth, because all participants (except one) performed all of the neutral task trials, it is not possible to conclude from the current data whether the effects of fear and motivational context on avoidance behaviour were specific for pain-related avoidance. Further refinement of the experimental paradigm may be necessary to

investigate this issue in future studies. Fifth, because fear of the painful stimulus was measured retrospectively (after the experimental manipulation), the association between fear and avoidance behaviour is purely correlational. Although fear of pain was not affected by the experimental manipulation, interpretation of our data as fear of pain having a causal effect on avoidance behaviour is not justified. Strictly seen, this would require a measurement of fear before the experimental manipulation. Sixth, we found that not only goal value of the pain task was higher in the competition group than in the control group, but also that goal value of the neutral task was significantly lower in the goal competition group than in the control group. Although the latter effect was not expected, it may be easily explained by competition between tasks. When participants are rewarded for performing trials of the pain task, this may reduce the value of the other task (competition group). When participants avoid trials of the pain task, they may compensate this by higher commitment to the other task, leading to larger goal value of the non-painful task (control group).

In sum, the present study demonstrates that avoidance behaviour is affected by the presence of competing goals, and that the association between fear of pain and avoidance behaviour depends – at least partly – from the motivational context. These findings indicate the urge for a more dynamic view on avoidance and disability, taking into account patients' goals. Such view may have important implications for treatment, and suggests that the application of motivational and self-regulation approaches may prove a fruitful avenue for refining and optimizing strategies aimed at the reduction of disability and the improvement of physical capacity in patients with chronic pain [2,28,29].

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Summary

Pursuing valuable goals reduces pain-related avoidance behaviour and the relation between fear and avoidance. This shows the need for a dynamic, contextual-motivational view on disability.

Figure legends

Figure 1. Scatter plot of association between fear of pain stimulus and number of avoided pain task trials separately for competition and control groups.

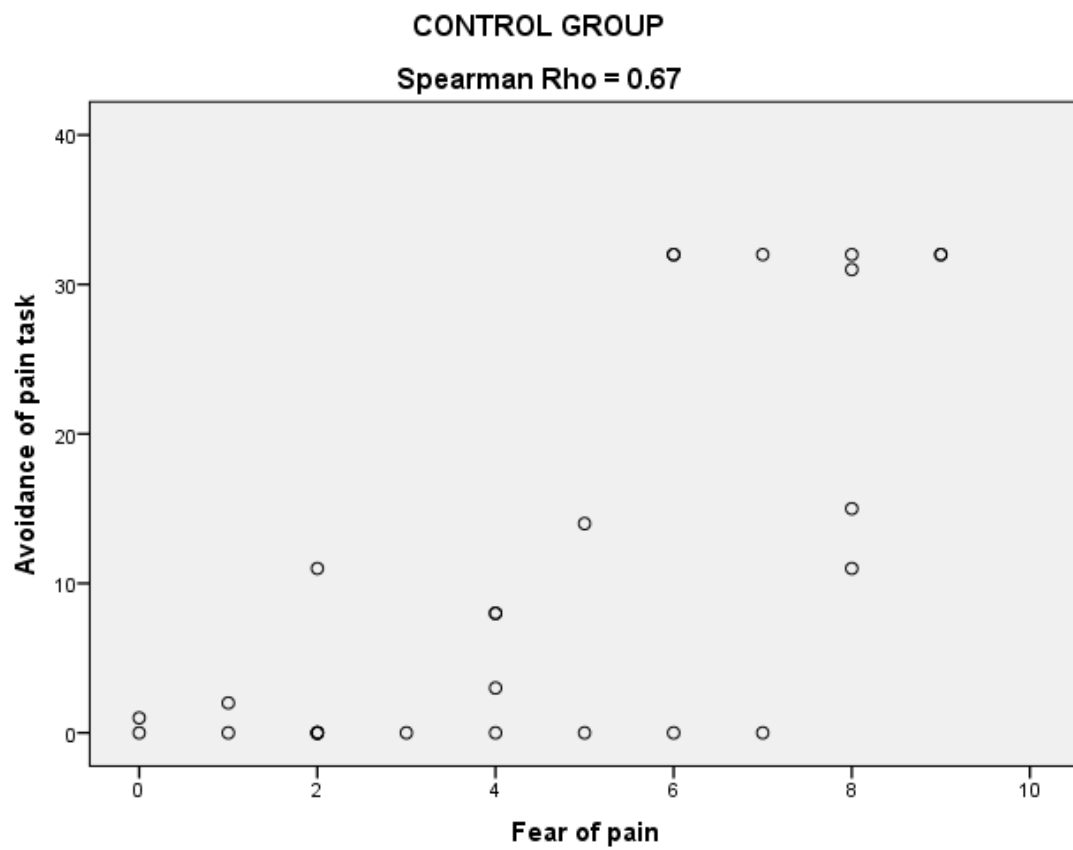
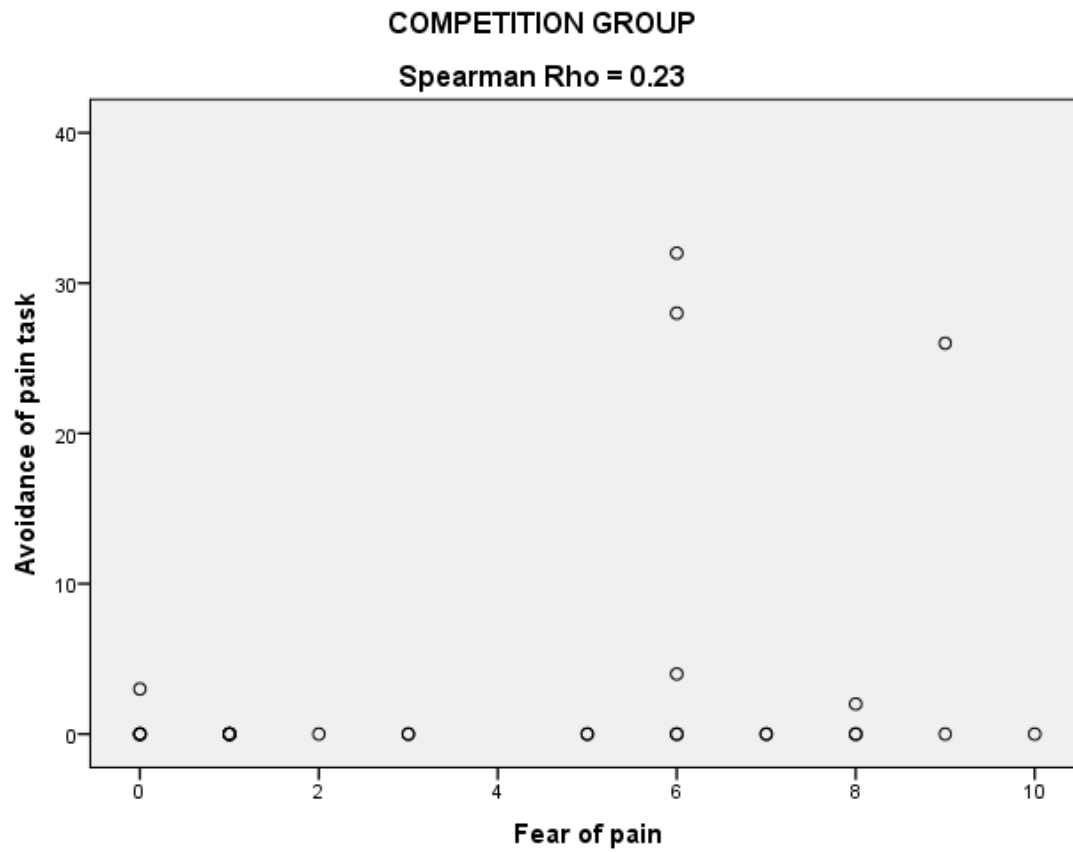


Table 1. Overview of sample characteristics, self-report data, and amount of avoided pain task trials. Values between brackets are standard deviations.

	Competition group (N = 28)	Control group (N = 27)
Age	18.75 (1.96)	18.68 (1.89)
Sex (% of females)	54%	56%
PCS	15.82 (7.49)	17.63 (7.46)
Pre-experiment aversiveness	5.13 (2.04)	4.67 (1.86)
Unpleasantness	-1.93 (1.25)	-1.89 (2.40)
Painfulness	4.25 (2.14)	4.15 (2.57)
Fear of pain stimulus	4.25 (3.35)	4.56 (2.83)
Goal value pain task	7.29 (2.55)	5.63 (3.23)
Goal value neutral task	5.68 (2.89)	7.33 (2.25)
N avoided pain trials	3.39 (9.01)	10.93 (13.40)