The role of motivation in distracting attention away from pain: an experimental study.

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ABSTRACT

Research on the effectiveness of distraction as a method of pain control is inconclusive. One mechanism pertains to the motivational relevance of distraction tasks. In this study the motivation to engage in a distraction task during pain was experimentally manipulated. Undergraduate students (N=73) participated in a cold pressor test (CPT) and were randomly assigned to three groups: a distraction-only group performed a tone-detection task during ther CPT, a motivated-distraction group performed the same task and received a monetary reward for good task performance, and a control group did not perform the tone-detection task. Results indicated that engagement in the distraction task was better in the motivated-distraction group in comparison with the distraction-only group. Participants in both distraction groups experienced less pain compared to the control group. There were no overall differences in pain intensity between the two distraction groups. The effect of distraction was influenced by the level of catastrophic thinking about pain. For low catastrophizers, both distraction groups reported less pain as compared to the non-distracted control group. This was not the case for high catastrophizers. For high catastrophizers it mattered whether the distraction task was motivationally relevant: High catastrophizers reported less intense pain in the motivated distraction group, as compared to the non-distracted control group. We conclude that increasing the motivational relevance of the distraction task may increase the effects of distraction, especially for those who catastrophize about pain.

1. Introduction

Distraction is an intuitive way of coping with pain and is part of many pain treatment programs [44]. The putative mechanism for its perceived effectiveness is attention: when attention is directed away from pain, less attention is available for pain, and less pain is experienced [39]. Although appealing, empirical evidence in support of this view is inconclusive [12,48]. Pain characteristics as well as distraction task characteristics may account for the disparities in empirical findings [13].

Until now, research has mainly focused on the effects of pain characteristics. Behavioural as well as neuropsychological studies have revealed that the capture of attention by pain is enhanced when pain is intense, novel, and threatening [5,6,7,11,34]. It may well be that distraction is less effective in these situations [13]. Largely unexplored is the influence of distraction task characteristics. This research has been predicated on the general capacity or resource models of attention [2,27] which state that there is a limited amount of cognitive resources that has to be divided between multiple demands. According to these models distraction tasks must demand more cognitive resources than pain in order to be effective. Studies investigating this idea have manipulated the difficulty of the distraction task. However, results do not support the central role of task difficulty [23,40,47], thereby challenging the validity of the capacity models.

It is possible that one's attentional engagement in a distraction task depends upon the affective-motivational characteristics of the task rather than its cognitive difficulty [13, 35]. Motivational models of attention [45] may then be more appropriate to understand distraction. According to these models the allocation of attention is determined by the activation of goals in working memory [34]. Goal-relevant information is given priority to enter in working memory and goal-irrelevant information is inhibited [17,19,49]. Motivationally relevant distraction tasks might therefore be more effective in diminishing pain [58], because they are more likely to get priority processing over pain. This hypothesis has not yet been tested.

Whether distraction works to reduce pain may also depend upon individual differences in catastrophic thinking about pain, which is defined as an exaggerated negative orientation towards actual or anticipated pain experiences [50]. Those who catastrophize about pain, experience pain as threatening, are hypervigilant to pain [9] and have difficulties disengaging attention from pain [55, 56]. It is therefore reasonable to assume that pain processing is prioritized over the processing of other information, making it more difficult to engage in a distraction task and as a consequence making distraction less effective [20, 21].

This study investigated whether the motivational relevance of the distraction task can enhance the effectiveness of distraction from laboratory controlled cold pressor pain. We hypothesized that participants would experience less pain when attention was directed away from pain. Further, we hypothesized that the effects of distraction would increase when participants are financially rewarded for good task performance. Finally, we hypothesized that distraction would be less effective for participants who catastrophize about pain.

2. Method

2.1 Participants

Seventy-eight undergraduate students (66 females, mean age=18.67 years, *SD*=1.36) from Ghent University (Belgium) participated in a cold pressor experiment. Data were collected in November 2007. All participants were Caucasian. The majority of the participants reported good medical and psychological health. Participants were excluded if they had a history of epilepsy, cardiovascular diseases, and cuts or sores on the hand to be immersed [62]. Good comprehension of the Dutch language was also required. Three participants were excluded: one did not fully understand Dutch, one had had a recent hand surgery, and one reported epilepsy. Furthermore, two participants were removed from the sample because of a large number of errors on the distraction task (> 3 SDs above the mean). Statistical analyses were conducted on a final sample of 73 participants (61 females, mean age= 18.73 years, *SD*=1.38). All participants participated to fulfill course requirements and provided a written informed consent. Participants were fully debriefed after the experiment. The experiment was approved by the ethical committee of the Faculty of Psychology and Educational Sciences of Ghent University.

2.2. Material

2.2.1. Cold pressor task (CPT)

The cold pressor apparatus used was a metallic water container (Techne B-26 with TE-10D, 530 x 325 x 172 mm). The water temperature was kept at 12 degrees Celsius (±0.01) using a circulating water pump (Techne Dip Cooler RU-200). We used a fixed immersion duration paradigm, in which participants had to immerse their hand in cold water for a fixed period of time. As a consequence our self-reported measure of pain is not confounded by tolerance time [12]. With this particular paradigm it is necessary that a sufficient number of participants endure the painful stimulation until the end.

Temperature and immersion interval were chosen based upon theoretical considerations and pilot studies. Previous distraction studies have used very low water temperatures (0-5°C), resulting in a relatively high dropout [i.e. 24]. Therefore we performed several pilot studies with a fixed interval paradigm with higher water temperatures. We started piloting at 7°C as research indicated that participants should be able to endure water of 7-8°C [22,43] for 1 to 2 minutes. Pilot studies (N=120 students) however revealed that with temperatures of 7°C and even 10°C and an immersion interval of two minutes, pain ratings were relatively high with less variation, and a relatively high number of participants was unable to tolerate the cold pressor pain for two minutes. Since distraction is thought not to work when pain is intense [13] we have chosen a water temperature of 12°C and an immersion duration of one minute. We expected that this would create a painful stimulus of average pain intensity which would be ideal to measure distraction effects and could be endured by most participants.

Another container (type Julabo TW20, 56x35x32 cm), filled with water at room temperature water (21°C), was used to standardize hand temperature before immersion of the hand in the cold water container [62].

2.2.2. Distraction task

The distraction task used was the Random Interval Repetition task (RIR; [59]). This task has been successfully used in previous distraction research [20,57]. The RIR-task is an attention-demanding tone-detection task, which requires executive processing. Participants are required to respond as quickly as possible to tones (tone duration=150 ms; tone pitch=750 Hz; inter stimulus interval 900 and 1500 ms) generated by a computer (ASUS L2000). Tones were presented at random stimulus interval through headphones (Sony MDR-V150). In this study, the total RIR-task duration was one minute during which 51 tones were presented. Responses were made by pressing a button pressing device, held in the right hand. Task performance was assessed by reaction times (RT), standard deviations (SD) and errors. RTs faster than 100 ms were considered anticipations and omitted. Outliers (RTs > 3 SD above the individual mean) and omissions were also removed [20,57]. Errors were calculated by summing anticipations and omissions. Task performance served as a behavioral measure for task engagement.

2.3. Self- report measures

2.3.1.Sample characteristics

Socio-demographic sample characteristics (i.e. sex, age, etc.) were assessed with an ad hoc questionnaire, which also included questions about participants' physical and psychological health.

Pain experience prior to the experiment was assessed with the Graded Chronic Pain Scale [63]. Research indicated that this questionnaire is valid and reliable for several pain problems [63]. This questionnaire contains several numeric rating scales (0-10) that measure pain intensity (three items, namely pain right now, worst pain and average pain during six months) and disability (three items, namely interference with daily activities, social activities and work activities). Total intensity and disability scores vary from 0-100. Participants also register the total number of disability days during the past six months (range 0-180). Participants are classified in grades 0 ("pain free") to 4 ("high disability-severely limiting").

2.3.2. Pain catastrophizing

Catastrophic thinking about pain was assessed with the Dutch version of the Pain Catastrophizing Scale (PCS;[8, 50]). This scale contains 13 items that measure catastrophic thoughts about pain in both clinical and non-clinical samples. Participants reflect on past painful experiences and indicate on a 5-point scale ranging from 0 (“not at all”) to 4 (“always”) the degree to which they experience each of the 13 thoughts or feelings during pain (i.e. “I become afraid that the pain may get worse”). Research has shown that the Dutch version of the PCS is valid and reliable [53]. In the present study Cronbach’s alpha of the total score was .85.

2.3.3. Self-reported attention to pain

Attention to pain was measured with two items that measured the same construct but were opposite in formulation to control for response tendency. Participants rated the amount of attention they paid to the pain and the extent to which they were able to distract themselves from the pain using a 11-point scale (0=“not at all”; 10=“very much”). An “attention to pain” score (range -10 to +10) was calculated by subtracting the ability to distract from pain from the amount of attention to pain. The higher the score, the more attention paid to pain during the CPT.

2.3.4. Self-reported distraction task experience

Distraction task experience and motivation to perform the task were assessed with six items. Participants were instructed to indicate the difficulty of the task, their interest in the task and the amount of attention paid to the task on a 11-point scale (0=“not at all”; 10=“very much”). They were also instructed to indicate the amount of effort that they put in the task and how important it was for them to perform the task correctly. Finally, participants' beliefs about the effectiveness of the distraction task were assessed.

2.3.5. Self-reported pain experience during cold pressor test (*CPT)*

Participants reported their experienced pain. A distinction was made between pain intensity and pain affect [12, 36]. Pain intensity was assessed with two items (Cronbach's alpha= .92). Participants indicated the worst pain and the pain just before the end of the immersion on a 11-point scale (0="no pain"; 10="the worst imaginable pain"). According to Kahneman et al [28] these two measures are valid indicators of the pain experience during the CPT. A total pain intensity score was computed (range 0-20).

Pain affect was assessed with three items (Cronbach's alpha=.64). Participants indicated how unpleasant the experience was and how anxious and tense they were during immersion on a 11-point scale (0="not anxious/relaxed/pleasant"; 10="very anxious/tense/unpleasant"). A total pain affect score was computed (range 0-30).

2.4. Experimental manipulation

Participants were randomly assigned (by lottery) to one of three experimental groups: (1) a distraction-only group (N=24), (2) a motivated-distraction group (N=23) and (3) a control group (N=26). In the two distraction groups the same distraction task was performed. In the motivated-distraction group, participants were rewarded for their task performance. We chose a feasible goal with a high goal value to create motivation [18]. Participants could win 10 eurocents every time they pressed the button quickly and accurately. If the response was given too late or inaccurately, they could lose 10 eurocents. Participants could earn a maximum of 6 euros. During the task no performance feedback was given. After the experiment, participants received

3, 4 or 5 euros for their task performance. This amount was randomly assigned and was unrelated to their actual performance.

2.5. Procedure

Participants received standard information about the experiment, when entering the experimenter's room. They were instructed to *"perform several cognitive tasks and a cold pressor test (CPT)"*. Furthermore, they were informed that *"the main interest of the experiment was to examine the effect of an aversive experience on cognitive functioning"*. The real purpose of the experiment was masked and participants were unaware that the experiment was about distraction from cold pressor pain. That way, potential placebo effects were kept at a minimum. After instructions, the PCS was assessed and participants performed the cognitive tasks, which were of no relevance in this study (task completion took approximately 30 minutes).

Next, participants received standard information about the cold pressor procedure. First, they had to immerse their left hand for one minute in the room temperature tank to standardize hand temperature [62]. Before the cold water immersion, participants in the two distraction groups received information about the distraction task. Both groups were instructed to *"focus on the task during immersion".* Participants in the motivated-distraction group were also informed of the importance to perform the task well. They were instructed that *"they could earn 10 eurocent every time they pressed the button fast and accurate and lose 10 eurocent every time they pressed the button too late or inaccurate, with the possibility to earn a maximum of six euro, which they would receive at the end of the experiment"*. Participants in the control group were instructed to *"keep their thoughts on the cold water and the pain they experienced"* [36]. Participants were also instructed to *"immerse their hand and* *wrist, not to form a fist and not to move their fingers"* [62]. After instructions, participants immersed their left hand in the cold water container for one minute. Immediately following the immersion, they answered questions about the experienced pain [32]. The distraction task questions were only assessed in the two distraction groups. The cold pressor procedure ended with a submersion for one minute in the room temperature tank for recovery [62]. Participants were debriefed at the end of the experiment. During the experiment the researcher stayed in the room, and sat behind a screen to minimize the contact with the participant.

2.6. Data-analysis

For data-analysis SPSS.15.0 was used. All variables entered in the data-analysis were normally distributed. First, the engagement of the participants in the distraction task was examined. Second, ANCOVA analyses were conducted to examine any effects of distraction on attention to pain, pain intensity, and pain affect. Catastrophizing was entered as a covariate in all analyses. As recommended by Van Breukelen et al [52], this variable was centred. Significant main effects were further evaluated using contrast analyses. We compared the control group with the two distraction groups to evaluate the global effect of distraction. Furthermore we compared the control group with the two distraction groups separately to gain more insight in the distraction effects and finally we compared the two distraction groups to see whether motivated-distraction has beneficial effects over distraction without extra motivation. A priori hypotheses were tested with one-tailed t-tests. Effect sizes were calculated by using Cohen's *d* (.20 'small', .50 'medium' or .80 'large' effects) or partial eta squared (ηp^2) (.01 'small', .10 'medium' and .25 'large' effects) [4].

3. Results

3.1. Sample characteristics

The majority of the participants (89%) had experienced some pain during the past six months (i.e. headache, stomach ache, back pain, etc.). Ninety percent was defined as non-persistent pain that was mildly disabling (M=31.70,SD=24.84;range 0-97) and of average intensity (M=45.38,SD=18.05;range 13-80). The majority of the participants (82%) was classified in grade 0 ("no pain problem"), 1 ("low disability-low intensity") or 2 ("low disability-high intensity"). Pain grades were equally distributed between experimental groups ($\chi^2(8)=8.06$, *ns*).

3.2. Manipulation checks

To investigate distraction task engagement in both distraction groups, ANCOVA analyses were conducted with behavioral task performance measures (reaction times, standard deviations and errors) as dependent variables, group as between subjects factor and catastrophizing as covariate (see Table 1). In comparison with the distraction-only group, the motivated-distraction group, performed the distraction task significantly faster ($F(1,43)=4.63, p<.05, d=.65$) without being less accurate ($F(1,42)=1.73$,ns,$d=.39$). Participants in the motivated-distraction group also showed less variability in response speed ($F(1,43)=4.90, p<.05, d=.66$). There were no main effects of catastrophizing or interaction effects of catastrophizing x group on behavioral task performance measures (all $F_s < 1.5$).

Furthermore, a MANCOVA analysis was conducted with self-reported distraction task experience measures (attention to the task, task difficulty, interest in the task, effort to perform, importance to perform and beliefs about the effectiveness of the task) as dependent variables, group as between subjects factor and catastrophizing as covariate (see Table 1). The multivariate test revealed a significant main effect of group on self-reported distraction task engagement (*F*(6,37)=2.42, *p*<.05, ηp =.28). Univariate tests were used to further examine the effects of the self-reported task engagement items separately. Results indicated that both groups reported an equal amount of attention paid to the distraction task (F<1). In comparison with the distraction-only group, the motivated-distraction group experienced the distraction task as more interesting (*F*(1,42)=4.24,*p*<.05,*d*=.58). They also expended more effort performing the task well (*F*(1,42)=9.40,*p*<.01,*d*=.87). Multivariate tests showed no main effects of catastrophizing, nor interaction effects of condition x catastrophizing on self-reported distraction task engagement (all F_s<1.3).

The results of behavioral as well as self-report measures clearly showed that the motivated-distraction group was more engaged in the distraction task than the distraction-only group, and that our manipulation of motivation was indeed successful.

- INSERT TABLE 1 –

Means and standard deviations of self-reported attention to pain are presented in Table 2. An ANCOVA analysis was conducted with attention to pain as dependent variable, group as between subjects factor and catastrophizing as covariate. Means and standard deviations of self-reported attention to pain are presented in Table 2. Results revealed a main effect of group on self-reported attention to pain (*F*(2,67)= 23.43, *p*<.01,ηp^2 =.41). Contrast analyses were performed to further evaluate significant main effects and test a priori hypotheses. Results showed a significant difference in attention to pain between the control group and both distraction groups (*t*(70)=6.44,*p*<.01,*d*=1.54). The distraction-only group (*t*(70)=4.60,*p*<.01,*d*=1.25) as well as the motivated-distraction group (*t*(70)=6.45,*p*<.01,*d*=2.07) reported significantly less attention to pain compared to the control group. The motivated-distraction group reported significantly less attention to pain than the distraction-only group ($t(70)=1.87, p<.05, d=.52$).

Furthermore, there was a main effect of catastrophizing on attention to pain ($F(1,67)=6.58, p<.05, \eta p^2=.09$), indicating that higher levels of catastrophizing were associated with more attention to pain. There was no interaction effect of catastrophizing x group on attention to pain ($F<1$).

- INSERT TABLE 2 -

3.3. Self-reported pain intensity

Means and standard deviations of self-reported pain are shown in Table 2. An ANCOVA with pain intensity as dependent variable, group as between subjects factor and catastrophizing as covariate revealed a significant main effect of group on pain intensity ($F(2,67)= 3.21, p<.05, \eta p^2=.09$). Contrast analyses were performed to further evaluate significant main effects and test a priori hypotheses. A significant difference in reported pain intensity was found between the control group and the two distraction groups ($t(70)=2.35, p<.05, d=.57$). The distraction-only group ($t(70)=1.88, p<.05, d=.52$) as well as the motivated-distraction group ($t(70)=2.16, p<.05, d=.67$) reported less pain intensity compared to the control group. There was no significant difference in reported pain intensity between the two distraction groups ($t(70)=.30$, ns, $d=.08$).

Furthermore, there was a significant main effect of catastrophizing on pain intensity ($F(1,67)=6.37, p<.05, \eta p^2 =.09$), indicating that higher levels of catastrophizing were associated with more pain. Finally, the interaction effect of catastrophizing x group on pain intensity approached the significance cut off of 5% ($F(2,67)=2.92$, $p=.06, \eta p^2 =.08$). To visualize this trend, we divided the sample into high ($N=39$, $M=23.46, SD=5.09$, range 17-36) and low catastrophizers ($N=34$, $M=10.78, SD=3.87$, range 3-16) using PCS- norm scores calculated in a large sample of Dutch-speaking undergraduate students (N=550) [53]. Group means are presented in Figure 1. Contrast analyses were performed to test differences between groups in reported pain intensity separately for high and low catastrophizers. For low catastrophizers, both distraction groups reported significantly less pain as compared to the non-distracted control group ($t(31)=1.98, p<.05, d=71$). This was not the case for high catastrophizers ($t(36)=1.55$, ns, $d=.49$). However, for high catastrophizers it mattered whether the distraction task was motivationally relevant: High catastrophizers reported less intense pain in the motivated distraction group, as compared to the non-distracted control group ($t(36)=1.81, p<.05, d=.79$), but there was no significant difference in pain intensity when comparing the distraction-only group with the non-distracted control group ($t(36)=.82$, ns, $d=.31$)[1]. This pattern of results was further substantiated by another series of one tailed t-tests. First, there was no difference in pain intensity between high and low catastrophizers in the control group($t(24)=-.97$, ns, $d=.38$). Second, low catastrophizers reported less intense pain than high catastrophizers in the distraction-only group ($t(22)=-2.04, p<.05, d=.84$).Third, there was no significant difference in pain intensity between high and low catastrophizers in the motivated distraction group ($t(21)=-.18$, ns, $d=.07$).

- INSERT FIGURE 1 -

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[1] Note: An ANCOVA in which the control group was compared to the distraction-only group and catastrophizing was used as a continuous variable showed an interaction trend of group x catastrophizing (F(1,46)=3.20, p=.08, $\eta p^2=.07$). No such interaction was found when the control group was compared with the motivated-distraction group (F(1,45)=.84, p=.36, $\eta p^2=.02$).

3.4. Self-reported pain affect

Means and standard deviations of self-reported pain affect are presented in Table 2. An ANCOVA analysis with pain affect as dependent variable, group as between subjects factor and catastrophizing as covariate, showed no differences in pain affect between the three groups (F<1). There was a trend towards a main effect of catastrophizing on pain affect ($F(2,67)=3.15, p=.08, \eta p^2=.05$) indicating that higher levels of catastrophizing were associated with more unpleasantness. There was no interaction effect of catastrophizing x group on pain affect ($F(2,67)=2.07$,ns,$\eta p^2=.06$).

4. Discussion

This study investigated whether the motivational relevance of a distraction task enhances the effectiveness of distraction. Participants were assigned to (1) a control group, (2) a distraction-only group, or (3) a motivated-distraction group. Findings can be summarized as follows. Results showed that, overall, participants in both distraction groups reported significantly less pain intensity compared to the control group. These results are consistent with other studies that also found similar beneficial effects of distraction on pain [25,26,37,38,42,51]. However, our study has further value over previous studies. Participants were unaware that this experiment was about distraction from cold pressor pain, thereby minimizing possible demand and expectancy effects [35]. This study also meets most of the methodological considerations raised by Eccleston [12] including pain measurement, standardisation of the pain induction method and measurement of distraction task engagement. We also followed guidelines for the use and standardisation of the cold pressor test [62]. This distraction study clearly showed an effect of distraction on pain intensity of moderate effect size.

Of further importance was the finding that the effect of distraction on pain intensity appeared to be moderated by pain catastrophizing. In line with previous research, high catastrophizers in our study reported more attention to pain [20,57] and more negative affect during pain [57]. Our results further showed that distraction was not effective for high catastrophizers in the distraction-only group. This finding complements previous studies which also found no effects of distraction from pain for high catastrophizers [20,21]. However, those who catastrophize about pain do seem to benefit from distraction when the distraction task becomes motivationally relevant.

There are various explanations for the finding that distraction does not work for high catastrophizing participants, but appears to work when the motivation to perform the task is enhanced. First, research has shown that attention is unintentionally captured by painful stimuli that are intense [13]. It is possible that high catastrophizers' ability to distract from pain was hindered because their pain was more intense. A motivationally relevant task may then be needed to overrule the attentional capture by pain and obtain effects of a distraction task. Our results, however, do not support this idea. In our non-distracted control group, high catastrophizers did not rate the pain as more intense than low catastrophizers.

A more plausible explanation may be found in the idea that those who catastrophize, tend to worry or ruminate about pain during other tasks in many situations [3], and that this negative mental set is not easily paused or stopped [15]. We have previously argued that when pain has become a primary concern of the mind, pain related information automatically captures attention [7,9,14,31,33,58]. It may be that a simple distraction task is not sufficient to halt catastrophic thinking about pain and prevent the capture of attention by pain. A more motivationally relevant task may be needed to temporary inhibit or displace worrying about pain in order to fully engage in the distraction task. Indeed, adding a reward clearly increased the effort to perform the distraction task in the motivated-distraction group for both high and low catastrophizers.

These findings may have clinical implications. Attention management strategies are often used in pain treatment programs [16,44]. Some researchers have suggested that the use of distraction protocols might be ineffective for high anxious patients and pain catastrophizers [46,54]. Others have suggested that other attentional strategies, in which attention is drawn to the pain and pain is reinterpreted (i.e. sensory monitoring) are perhaps more fruitful for high anxious and high catastrophizing individuals [21,46]. This study, however, shows that distraction might also be effective for high catastrophizers, on the condition that the distraction task is motivationally relevant.

This study has some limitations. First, the participants of this study were all undergraduate students, the painful stimulation was created and delivered in the laboratory, and there were no extreme levels of catastrophic thinking about pain. Further research is needed to demonstrate whether our results can be replicated with a non-student sample experiencing clinically relevant pain. Second, we found no effects of distraction on pain affect. This is not consistent with previous studies that have demonstrated effects on both pain affect and intensity [41,42,51], but is similar to studies which have shown that the manipulation of attention clearly alters pain intensity, but influences pain affect to a far lesser degree [29,30,61]. It is possible that our pain affect measure was less sensitive and therefore not reached significance. Third, we used a distraction task that had theoretical advantages: it was attention-demanding [59], directed attention to an external cue [26] and involved another perceptual modality [60]. The task was, however, not rated as very interesting. This offers a challenge for future research. It will be important to find ways to further enhance motivation in distraction tasks. One interesting idea might be to explore the use of feedback on task performance [1]. Another major challenge for experimental as well as clinical populations, is to optimize distraction tasks in a way that they match personal and valued goals. Fourth, it is difficult to disentangle whether the distraction effects in our study are related to an enhanced motivation or to positive affect. It is possible that adding a reward to the distraction task has created a positive affect. Previous studies have shown that positive affect can diminish pain [10,41,61]. Such an explanation is however unlikely. Positive affect mainly alters pain affect, not pain intensity [61], and we observed the reverse. Finally, the differential effects of motivation on distraction effectiveness for high and low catastrophizers are interesting, but further research is necessary to replicate our findings. Low statistical power might have resulted in the detection of moderate rather than small effect sizes.

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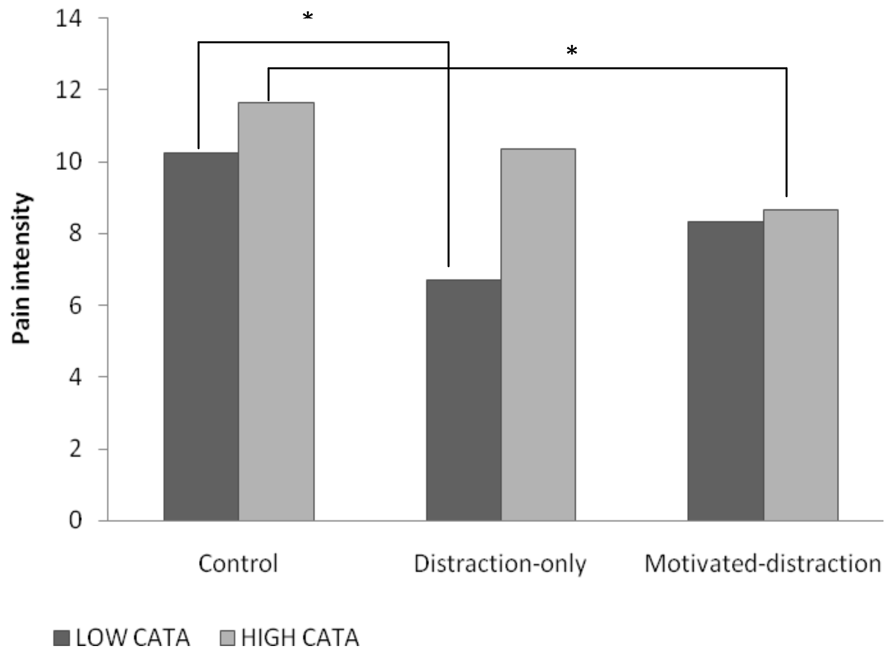
FIGURES

Figure 1: Interaction between group and catastrophizing on pain intensity



*p<.05

TABLES

Table 1

Means and standard deviations of behavioral and self-reported distraction task (RIR) engagement measures

	Distraction-only (N=24)	**Motivated-distraction (N=23)**
Reaction times RIR	259.98 (59.57)	224.77 (48.03)
Standard deviations RIR	78.33 (40.25)	56.46 (23.63)
Errors RIR	2.13 (2.11)	1.41 (1.53)
Attention to RIR	8.13 (1.42)	8.43 (1.31)
Difficulty	2.78 (2.13)	2.22 (1.76)
Interest in RIR	3.96 (2.48)	5.39 (2.46)
Importance to perform	6.96 (1.74)	7.30 (1.69)
Effort to perform	5.87 (2.51)	7.74 (1.68)
Beliefs effectiveness RIR	6.87 (2.18)	7.00 (2.11)

Table 2

Means and standard deviations of self-reported attention and pain during the CPT

	Control (N=26)	**Distraction only (N=24)**	**Motivated Distraction (N=23)**
Attention to pain	3.08 (2.83)	-1.08 (3.80)	-2.83 (2.89)
Pain intensity	11.00 (3.63)	8.83 (4.62)	8.48 (3.94)
Pain affect	15.81 (5.48)	14.58 (5.53)	14.17 (3.68)