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The role of current mood and stop rules on physical task performance: An experimental investigation in patients with work-related upper extremity pain

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ABSTRACT

Patients with work-related upper extremity pain (WRUED) experience disability in daily life activities. The factors that influence levels of disability are still unclear. Both excessive avoidance and persistence have been suggested, but the affective and motivational processes that underlie these behaviours have not been scrutinized. This study was aimed at examining the role of current mood and stop rules on physical task performance, controlling for gender, pain severity, pain catastrophizing, and pain-related fear. An additional focus was the role of the interaction between current mood and stop rules as predicted by the novel Mood-as-Input (MAI) model. Following MAI, it is the informational value of current mood within a goal context (stop rule), rather than mood per se that predicts behaviour. A 2 (mood) × 2 (stop rule) × 2 (physical task order) factorial design was used in which 62 WRUED patients performed an upper and lower extremity physical task. A stress interview was used to induce positive and negative mood. Patients received either an "as-much-as-can (AMAC)" stop rule instruction, or a "feel-like-discontinuing (FLDC)" stop rule instruction. Results showed that physical task performance was predicted by pain-related fear, current mood, stop rule. However, the predicted mood × stop rule interaction was not found, and there was no influence of gender, pain severity, and pain catastrophizing on task performance. The findings suggest that not only pain-related fear, but current mood and goal context factors independently affect physical performance in patients with WRUED.

1. Introduction

Work-related upper extremity pain disorders (WRUEDs) hold great socio-economic and personal problems due to sickness absence, medical expenses and disability in daily life activities (e.g. Feuerstein et al., 2005; Pransky et al., 1997). In The Netherlands, 20–40% of the working population report complaints in the upper extremities, with neck and shoulder-pain being most prevalent (e.g. Bloemsaat et al., 2004). Despite its high prevalence, it remains unclear what mechanisms contribute to reduced task performance in WRUED.

Pain-related fear has shown to predict reduced performance levels in patients with musculoskeletal pain (Leeuw et al., 2007; Vlaeyen and Linton, 2000), in both acute (e.g. Swinkels-Meewisse et al., 2006) and chronic patients (e.g. Heuts et al., 2004; Hursey and Jacks, 1992; Nederhand et al., 2004), including patients with WRUED (Huis 'tVeld et al., 2007; Karels et al., 2007). However, there is also evidence that in some patients the level of disability is associated with persistence rather than avoidance behaviour (e.g. Arntz and Peters, 1995; Hasenbring et al., 2008; Pascarelli and Hsu, 2001; Szeto et al., 2005; Vlaeyen and Morley, 2004).

One enticing model that may account for both persistence and avoidance behaviour in patients with chronic pain is the Mood-as-Input model (MAI; Martin et al., 1993). A key element is that the informational value of current mood in a certain goal context predicts task performance, rather than the mood or goal pursuit per se. Mood-as-Input specifically differentiates between result-oriented and hedonic goals or stop rules. When individuals adopt an as-much-as-can (AMAC) stop rule, and consequently ask themselves "Am I satisfied with the result of the task?", current negative mood informs them that not enough progress has been done, leading to task persistence. When individuals adopt a feel-like-discontinuing (FLDC) stop rule and ask themselves "Am I enjoying this task?" the same negative mood tells them that the task is not enjoyable anymore, increasing the probability of task disengagement. For positive mood, the opposite effects are expected, predicting a statistical interaction between current mood and stop rules (Fig. 1). Support for the Mood-as-Input hypothesis is found in non-clinical studies using cognitive tasks (e.g. Davey et al., 2005; MacDonald and Davey, 2005; Martin et al., 1997; Watkins and Mason, 2002).

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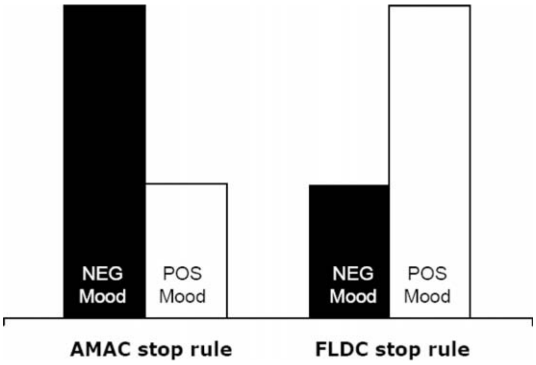

Fig. 1. Graphical presentation of the predictions in task performance based on the Mood-as-Input model (Martin et al., 1993; Vlaeyen and Morley, 2004).

The aim of the present study was to test whether current mood, stop rules and their interaction explain task performance in patients with WRUED above the effects of pain-related fear, pain catastrophizing or pain severity. We decided to use an experimental design in which we manipulated stop rules and current mood. For ecological validity purposes, we chose a physical rather than cognitive task. It was expected that greater task persistence is observed in participants who are in a negative mood, and who adopt an AMAC stop rule, and in participants who are in a positive mood, adopting the FLDC stop rule, even when controlling for the level of pain-related fear, pain catastrophizing and pain severity. An additional research question was whether these effects are pain–specific. Therefore, participants were requested to perform two tasks, one involving the upper extremities and one the lower extremities.

2. Method

2.1. Participants and design

Sixty-two patients with WRUED-diagnosis participated in this study on a voluntary basis; 38 were female and 24 were male. Ages ranged from 20 to 58 years with a mean age of 37.17 years (*SD* = 11.35). They all met the following inclusion criteria: (1) non-specific WRUED for at least 3 months and (2) able to speak and read in the Dutch language. Exclusion criteria were acute complaints associated with trauma, systemic disorders and neurological disorders according to the criteria document for evaluating the work-relatedness of upper extremity musculoskeletal disorders (Sluiter et al., 2001). Participants were recruited through advertisements in local weekly papers, posted fliers, email and a radio-interview on a local broadcasting channel.

2.2. Design

A 2 (mood condition: positive versus negative) × 2 (stop rule: AMAC versus FLDC) × 2 (physical task: upper extremity [UE]/lower extremity [LE]) × 2 (sequence: UE first versus LE first) factorial design was used, with mood, stop rule and sequence as between-subjects factors, and physical task as within-subjects factor. Participants were randomly assigned to one of the six conditions.

2.3. Stimulus materials

2.3.1. Mood induction

The procedure to induce positive and negative moods was modelled on that reported by Dimsdale, Stern, and Dillon (1988). Earlier findings suggest that recall interviews regarding different emotional events can elicit self-reported valence and arousal in the expected mood (Burns et al., 2003). Participants were asked to join in a semi-structured interview of 5 min. During this interview, participants were asked to give a detailed description of a positive versus a negative event they experienced in their life. The instruction was to focus on negative or positive feelings and thoughts. The experimenter guided the participant in concentrating on thoughts and emotions by asking specific questions like ("How did you feel then?") and reflections ("You must feel very bad at the moment"). To enhance mood induction, the interview was combined with light-effects and background music similar to an earlier study (Startup and Davey, 2001). Participants in the negative mood condition were exposed to dimmed lighting while they listened to an excerpt of 'Lux Aeterna' by Gyorgi Ligiti. Those assigned to the positive mood condition listened to 'The Four Seasons' by Antonio Vivaldi while there was bright light in the laboratory.

2.3.2. Experimental tasks

Participants were asked to perform two physical performance tasks. In the upper extremity (UE) task, participants sat in a chair and kept a handle that was connected with a 1 kg weight. The instruction was to make vertical movements with their painful arm in a stretched position. This task was successfully used in a previous study (De Gier et al., 2003). In the lower extremity (LE) task, participants were requested to make vertical movements with the lower part of their leg by bending their knee. Again, participants were sitting in a chair where the same 1-kg weight construction was tied to their ankle. The LE task was included to test whether the Mood-as-Input predictions were restricted to the affected body region or not. Both tasks were offered in a counterbalanced order. Time spent on the task and numbers of movements were the dependent variables.

2.4. Measures

2.4.1. Demographics

Demographic variables were measured in order to exclude the possibility that differences in physical performance could be explained by age, gender, education (high versus low education), work (yes versus no employment), absence from work due to upper extremity complaints (yes versus no), and use of medication (yes versus no). In addition, the questionnaire included items regarding the presence of specific diagnoses (based on Sluiter et al., 2001).

2.4.2. Disability

The disability of the arm, shoulder, and hand questionnaire (DASH; Hudak et al., 1996; Dutch version: Veehof et al., 2002) is a 30-item self-report measure of disability related to upper extremity disorders. The items refer to the degree of difficulty in performing different physical activities because of the arm, shoulder or hand problem (30 items). The scores on all items were summarized in the three DASH total scores that range from 0 (no disability) to 100 (most severe disability). The DASH is a psychometrically sound measure of disability related to upper extremity related disability (e.g. De Smet et al., 2007).

2.4.3. Pain

To assess baseline pain, participants completed three questions about their pain experiences during the last week. These questions were: (1) How intense was your worst pain experience during the last week? (2) How intense was your slightest pain experience during the last week? (3) How intense is your pain experience at the present time? Participants indicated the intensity of their pain on a 100-point visual-analogue scale, ranging from 0 (no pain at all) to 100 (intolerable pain). The mean of the three ratings was used in subsequent statistical analyses as a measure for baseline pain intensity.

2.4.4. Mood

The 8-item mood questionnaire described by Davey et al. (2003) was used. Participants were asked to rate their current levels of anxiety, sadness, happiness, alertness, frustration, pride, shame, and interest on separate 100-point visual-analogue scales (where 0 = not at all and 100 = very much so). The VAS-scales were administered four times (at baseline, after the mood induction, after physical task 1 [UE/LE], after physical task 2 [UE/LE]).

2.4.5. Pain catastrophizing

The Pain catastrophizing scale (PCS; (Sullivan et al., 1995b) consists of 13 items (e.g. 'I keep thinking about other painful events', 'I feel I can't stand it anymore') that follow the statement 'When I am in pain. . .'. Participants need to indicate the degree of certain experienced thoughts or feelings during pain, on a 5-point scale, ranging from 0 (not at all) to 4 (always). The total score ranges between 0 and 52, with higher scores indicating more catastrophizing thoughts and feelings about pain experiences. The PCS shows good psychometric properties (Osman et al., 1997; Sullivan et al., 1995a; Van Damme et al., 2002).

2.4.6. Pain-related fear

The Dutch version of the Tampa scale of kinesiophobia-11 (TSK; Miller et al., 1991) was used to assess fear of movement/(re) injury (Goubert et al., 2004). The TSK-11 comprises two subscales. The first subscale (6 items) refers to avoidance of activity (TSK-AA), reflecting the belief that activity may result in increased pain or (re)injury (i.e. "I can't do all the things normal people do because it's too easy for me to get injured"), whereas the second subscale (5 items) refers to somatic focus (TSK-SF), representing a belief in serious medical problems underlying pain (i.e. "I wouldn't have this much pain if there weren't something potentially dangerous going on in my body"). The items are rated on a 4-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). Subscale scores range from 6 to 24 for the TSK-AA and from 5 to 20 for the TSK-SF. The two factor-model of the TSK-11 shows good psychometric properties and has an invariant factor structure across patients with various musculoskeletal pain diagnoses, including patients with WRUED (Roelofs et al., 2007).

2.5. Procedure

The experiment was approved by the Medical Ethics Committee of the Maastricht University. Participants were invited individually to the laboratory. After the introduction and informed consent, participants were asked to complete PCS, TSK, and visual-analogue scales (VAS) for pain and mood. Participants were exposed to the mood induction procedure, completed mood scales, and carried out the UE and UL task. In the AMAC stop rule condition, participants were told: "*As you perform on the physical task, ask yourself: 'have I made as many movements as I can?' If the answer is 'yes', then stop. If the answer is 'no', then continue. Stop when you are convinced you did as many movements as you possibly could make. There is no right or wrong time to stop*". In the FLDC stop rule condition, participants received a different instruction: "*As you perform on the physical task, ask yourself: 'am I enjoying this task?' If the answer is 'yes', then continue. If the answer is 'no', then stop*". Between the two physical tasks, participants listened to the background music that was used during the mood induction procedure for 1 min, cueing positive or negative moods. After each physical task participants completed the VAS for mood and pain. At the end of the experiment, participants were debriefed, thanked and paid € 10, for their participation.

2.6. Statistical analyses

In order to check whether the experimental groups differ on demographic variables, ANOVA's and chi-square tests were used. To determine whether the mood questionnaire comprises a positive and negative mood dimension an exploratory factor analysis was conducted on the first mood ratings using Varimax rotation. Factors with an eigenvalue of >1 were retained, according to the Kaiser Criterion. Moreover, only items with a factor loading exceeding .30 were retained (Jolliffe, 1972). A 2 (mood condition: positive versus negative) × 4 (time of measurement: baseline, after mood induction, after physical task 1 [UE/LE], after physical task 2 [UE/LE]) for repeated measures MANOVA was conducted to test if the mood-manipulation was successful, with positive and negative mood as the dependent variables, mood condition as between-subjects factor and time of measurement as within-subjects factor. Post-hoc *t*-tests were conducted if the main and interaction effects turned out to be significant.

Pearson's product–moment correlations were conducted to test whether severity of pain, pain catastrophizing and pain-related fear were related to physical task performance. If the relations turned out to be significant pain severity, pain catastrophizing or pain-related fear were included as covariates in subsequent analyses. To test if mood and stop rules influenced task persistence, a 2 (mood condition: positive versus negative) × 2 (stop rule: AMAC versus FLDC) × 2 (physical task: UE/LE) × 2 (sequence: UE first versus LE first) MANCOVA for repeated measures was carried out, with mood, stop rule and sequence as between-subjects factors, physical task as within-subjects factor and number of movements as dependent variable. Pain intensity, pain catastrophizing and pain-related fear were included as a covariate if Pearson's product–moment correlations with the dependent variables were statistically significant. Finally, post hoc *t*-tests were conducted in case of significant interaction effects.

3. Results

3.1. Participants

The sample consisted of 62 patients who met the WRUED as described by Sluiter et al. (2001) (24 male, mean age = 39 years, *SD* = 12.3, and 38 women, mean age = 36 years, *SD* = 10.6). Duration of pain complaints was 41 months (*SD* = 28.8). The participants reported pain in the following upper extremity parts: shoulder (69%), wrist (62%), elbow (60%), lower arm (57%), hand (55%), neck (40%), and upper arm (36%). The participants were relatively highly educated, with 45.1% having a higher education degree, and the majority (72.6%) had a paid job. Of these, 40.3% were on sick leave or permanently disabled at the time of the study. A relatively small number of participants (24.2%) was taking medication for their pain complaints. The participants had a mean score of 37.9 on the DASH, which suggest moderate disability levels, comparable to other samples (Roelofs et al., 2007; De Smet et al., 2007). There were no significant gender differences, except that women reported being more disabled as compared to the male participants ($F = 11.3$, $p < .01$).

3.2. Randomization check

Results of chi-square tests and ANOVA's showed no significant differences between the four Mood-as-Input conditions in demographic characteristics ($p > .05$). Therefore, results on the experimental tasks are not attributable to differences in age, gender, pain duration, education, employment, absence from work due to WRUED, baseline pain, use of medication, and disability.

3.3. Manipulation check

An exploratory factor analysis was conducted on the first mood ratings using Varimax rotation. A two factors solution was retained. The first factor, accounting for 33% of the total variance was labelled negative mood, and was composed of the items anxiety, sadness, frustration, and shame (all factor loadings > 0.6). The second factor, accounting for 24% of the total variance was labelled positive mood, and included the items happiness, alertness, pride, and interest (all factor loadings > 0.6). Chronbach's alpha was $\alpha = .75$ and $\alpha = .70$, respectively.

To test whether intended mood inductions were successful, a 2 (mood condition: positive versus negative) × 4 (time of measurement: baseline, after mood induction, after physical task 1 [UE/LE], after physical task 2 [UE/LE]) repeated measures MANOVA was conducted with the positive and negative mood scales as dependent variables (see Table 1). This analysis showed a main effect of mood condition, $F(1, 61) = 8.11$, $p < .001$, $\eta^2 = .22$, and of time of measurement $F(1, 61) = 6.30$, $p < .001$, $\eta^2 = .41$ that was superseded by an interaction effect between mood and time of measurement $F(1, 61) = 6.97$, $p < .001$, $\eta^2 = .43$, for the positive $F(1, 61) = 13.91$, $p < .001$, $\eta^2 = .19$ and the negative mood scale $F(1, 61) = 22.45$, $p < .001$, $\eta^2 = .27$. Follow-up *t*-tests of the positive scale demonstrated that participants experienced more positive moods in the positive than in the negative mood condition during baseline $t(60) = 2.53$, $p < .01$, after the stress interview, $t(60) = 5.76$, $p < .001$, after the first physical task, $t(60) = 2.92$, $p < .01$, and after the second physical task, $t(60) = 2.51$, $p = .02$. However, the mood induction appeared to be most effective immediately after the stress interview. Participants experienced more positive moods in the positive mood condition, $t(30) = -4.38$, $p < .001$, and less positive moods in the negative mood condition as compared to baseline, $t(30) = 3.51$, $p < .001$. Follow-up *t*-tests of the negative mood scale also demonstrated that the mood induction procedure was most effective immediately after the stress interview. Only then participants in the negative mood condition scored significantly higher on the negative mood scale as compared to those in the positive mood condition, $t(60) = -5.37$, $p < .001$.

3.4. Potential confounders

Table 3 displays Pearson product–moment correlations between the number of movements and time spent on the tasks and pain severity, pain catastrophizing, pain-related fear (subscales: TSK-AA, TSK-SF) and gender. Participants spent significantly more time on the UE task ($r(62) = -.28$, $p = .03$) and made more movements with the upper extremity ($r(62) = -.27$, $p = .02$) when experiencing less fear of (re)injury during activity (TSK-AA). Pain severity, pain catastrophizing and the somatic focus scale of the TSK (TSK-SF) were not related to the outcome measures ($p > .05$). Therefore, TSK-AA only was included as a covariate in the subsequent analyses.

3.5. Current mood and stop rules

A 2 (positive versus negative mood) × 2 (stop rule: AMAC versus FLDC) × 2 (physical task: UE/LE) × 2 (sequence: UE task first versus LE task first) repeated measures MANCOVA was conducted with number of movements as dependent variable and pain-related fear as a covariate to determine whether the interaction between mood and stop rule influenced physical performance. The means and standard deviations are displayed in Table 2. The assumption of homogeneity of regression was satisfactory. There was no significant effect of task, suggesting that the same predictors hold for tasks that involve the painful upper extremity body parts but also tasks involving other body parts. There was also no significant within-subject order effect, suggesting that it did not matter whether the UE task was performed first or after the

Table 1
Means and standard deviations of positive and negative mood in the positive and negative mood condition.

	Baseline *M* (*SD*)	After stress interview *M* (*SD*)	After physical task 1 (UE/LE) *M* (*SD*)	After physical task 2 (UE/LE) *M* (*SD*)
Positive mood condition[a]				
Positive scale	64.54 (16.54)	73.23 (16.70)	63.17 (17.89)	64.37 (17.65)
Negative scale	12.14 (16.15)	6.98 (10.33)	10.24 (12.64)	8.70 (11.93)
Negative mood condition[a]				
Positive scale	54.64 (14.26)	45.58 (20.87)	49.85 (18.07)	52.97 (18.06)
Negative scale	12.26 (11.86)	32.66 (24.57)	15.01 (19.59)	12.21 (13.39)

[a] $n = 31$.

Table 2
Means (*M*) and standard deviations (*SD*) of the dependent variables and possible confounding variables in the four Mood-as-Input conditions.

	Positive mood condition		Negative mood condition	
	AMAC[a] *M* (*SD*)	FLDC[b] *M* (*SD*)	AMAC[b] *M* (*SD*)	FLDC[a] *M* (*SD*)
Number of movements UE task	261.50 (120.61)	140.07 (144.13)	163.80 (146.75)	97.06 (104.03)
Number of movements LE task	213.94 (125.29)	133.13 (159.00)	149.93 (95.66)	91.69 (80.50)
Pain severity during UE task (0–100)	58.19 (24.31)	34.27 (22.86)	47.80 (23.91)	40.31 (25.65)
Pain severity during LE task (0–100)	42.06 (23.13)	27.27 (24.53)	37.40 (27.67)	29.31 (23.15)
Pain catastrophizing (PCS; 0–52)	15.06 (6.43)	14.00 (7.82)	13.93 (7.28)	11.19 (5.56)
Pain-related fear: (TSK)				
TSK-activity avoidance (6–24)	13.63 (4.18)	14.27 (3.28)	14.53 (2.50)	14.31 (2.94)
TSK-somatic focus (5–20)	11.69 (3.22)	10.47 (3.81)	10.67 (2.64)	11.00 (2.48)
Disability (DASH; 0–100)	38.38 (7.92)	32.72 (16.79)	40.83 (18.25)	39.84 (19.55)

Note. Abbreviations: AMAC, "as-much-as-can" stop rule; FLDC, "feel-like-discontinuing" stop rule; UE: upper extremity; LE: lower extremity; PCS: Pain catastrophizing scale; TSK: Tampa scale of kinesiophobia; DASH: Disability of arm, shoulder and hand.

[a] $n = 16$.

[b] $n = 15$.

Table 3
Pearson correlations between number of movements on the upper extremity (UE) and lower extremity (LE) task and gender, pain severity, pain catastrophizing, pain-related fear.

	UE number of movements[a]	LE number of movements[a]
Gender	−0.19	−0.1
Pain severity	−0.13	−0.22
Pain catastrophizing (PCS)	0.11	0.03
Pain-related fear		
TSK-activity avoidance	−.29[*]	−0.09
TSK-somatic focus	−0.05	−0.06
LE number of movements	.48[**]	
UE movement time	.88[**]	
LE movement time		.88[**]

[a] $n = 62$.

[*] $p < .05$ (two-tailed).

[**] $p < .01$

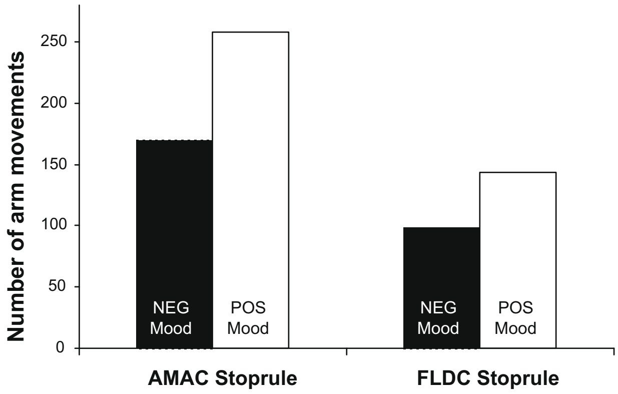

Fig. 2. Graphical presentation of the results in task performance: estimated marginal means of arm movement bouts in the four conditions.

LE task, and all interaction terms with the between-subject factors did not reach statistical significance. In contrast to the predictions, the interaction between mood and stop rule did not reach statistical significance $F(1, 61) = 0.43$, $p = .52$, $\eta^2 = .008$. The analysis revealed only three significant main affects: participants in the positive mood condition made significantly more movements as compared to those in the negative mood condition, $F(1, 61) = 5.59$, $p = .02$, $\eta^2 = .10$. In addition, participants who were explicitly requested to adopt an AMAC stop rule made significantly more movements compared to those adopting a FLDC stop rule, $F(1, 61) = 10.00$, $p = .003$, $\eta^2 = .16$ (see also Fig. 1). Moreover pain-related fear (TSK-AA) was significantly related to physical performance. That is, irrespective of mood and stop rule condition, participants who experienced less fear of movement/(re) injury made significantly more movements $F(1, 61) = 4.04$, $p = .049$, $\eta^2 = .07$ (see Fig. 2).

4. Discussion

The purpose of this study was to experimentally investigate the influence of current mood and goals (stop rules) on physical task performance in patients with WRUED, controlling for the contribution of pain-related fear, pain catastrophizing and pain severity. Results can be summarized as follows. First, no support for the Mood-as-Input hypothesis was found as the predicted mood × stop rule interaction did not reach significance. However, and in line with earlier studies in chronic musculoskeletal pain, physical performance was predicted by pain-related fear, irrespective of the experimentally manipulated current mood and stop rules. Patients who reported increased fear of movement performed less as compared to the low fearful patients. Also in line with previous studies, pain severity was not associated with physical performance (e.g. Crombez et al., 1999). An additional and novel finding however was that there were independent main effects of both current mood and stop rule. Patients who adopted the AMAC stop rule carried out more movement bouts than those adopting the FLDC stop rule, and patients whose current mood was positive performed better than those in current negative mood. These findings suggest that contextual factors such as current goals and mood may override or inhibit the automatic tendency of habitually fearful pain patients to escape from a threatening movement. However, some caution is warranted as the measure of pain-related fear that was used in this study is based on self-report, and probably tapping the belief that pain associated with movements is signalling (re)injury, and not the emotion fear per se (e.g. Leeuw et al., 2007).

Also in the current sample of patients with WRUED, pain-related fear was an independent predictor of physical performance. This finding corroborates the results of earlier studies showing that fear of movement/(re)injury is associated with diverse performance measures in patient populations with back pain (Swinkels-Meewisse et al., 2006; Vlaeyen et al., 1995a), neck pain (Nederhand et al., 2004) and WRUED (Huis 'tVeld et al., 2007). Also, the reduction of pain-related fear by means of exposure-based treatment is associated with improved functional status (de Jong et al., 2008; Linton et al., 2008) and increased pain tolerance (Vlaeyen et al., 2002a). Of interest was the absence of an effect of pain catastrophizing, which echoes earlier findings that suggest that pain-related fear and pain catastrophizing are associated with different aspects of the pain experience. For example, a recent study using a cold-pressor task showed that only pain-related fear uniquely contributed to pain tolerance levels, while pain catastrophizing was the best predictor of pain intensity ratings (George and Hirsh, 2008).

The independent contribution of mood is in line with earlier studies in healthy subjects showing that positive emotions influence pain tolerance (de Wied and Verbaten, 2001; Zillmann et al., 1996), but our study additionally shows that these effects still hold in patients, of whom some report increased pain-related fear. Similar effects are seen for current goals, supporting the idea that motivational factors may influence pain processing (Karoly and Ruehlman, 1996; Van Damme et al., 2008).

Of interest is that the same predictors hold for both the task involving the painful upper extremity body parts as well as the task that involves the lower extremity. One possibility is that the behavioural response to the upper extremity movements easily generalized to similar movements, as occurs in fear learning (Lissek et al., 2008). Although we failed to assess pain in other than the upper extremity body parts, it is likely that a substantial number of participants also experienced pain in other body parts as well (Kamaleri et al., 2008).

Unexpectedly, performance on the physical tasks was not determined by the statistical interaction between mood and stop rule. There are several possible explanations for the lack of support for the MAI prediction in the present study. *Firstly*, the sample size may not have been large enough. However, given the pattern of differences between the four conditions, it seems unlikely that with more participants in each condition the predicted "mood × stop rule" interaction would become significant. *Secondly*, results showed that the effect of the mood induction procedure vanished rapidly. That is, even though participants in the positive mood condition experienced more positive moods than participants in the negative mood condition throughout the experiment, participants' mood returned to baseline levels quickly after the first physical task. As a result, participants may not have used their moods as an informational source because they experienced similar moods as they would normally experience. In future studies other mood induction procedures such as emotional film fragments or negative or positive false feedback on task performance may be considered (Martin et al., 1993; van den Hout et al., 2001). *Third*, in the present study, mood was manipulated by a semi-structured interview in which participants were requested to give a detailed description of a positive or negative event while focussing on their negative or positive feelings and thoughts. Although this procedure was successfully used as a mood induction procedure by Burns et al. (2003), participants may have understood that the purpose of the interview was to change their mood. It is possible that participants only use their moods as an informational source when they are unaware of its causes, such as when watching films for a movie rating task (Martin et al., 1993, 1997). Therefore, participants in the present study may not have used their mood as an informational source to evaluate whether they reached their goal or not. *Fourth*, to the best of our knowledge, this is the first study that tested the applicability of the Mood-as-Input model on physical, rather than cognitive tasks. In earlier MAI studies only cognitive tasks were used such as an impression formation task (Martin et al., 1993), a check for security-generation task (Davey et al., 2003) and a task where subjects had to generate uses for a knife (Sanna et al., 1996). In these studies, the motivational context was used by the participants to disambiguate the induced positive and negative mood states. The same mood had a different meaning depending on the motivational context, which was substantiated by a mood × stop rule interaction. In our study however, the need for disambiguation of the induced mood might have been reduced as the participants with a history of pain might have learned that physical performance and the associated bodily sensations often are associated with mood changes (e.g. Connelly et al., 2007). As such, mood and motivational context might have acted independently upon the performance. *Finally*, attention is needed for the relevance of the physical tasks. In the current study, participants were told that this was an experiment concerning pain and task performance in patients with WRUED and that this study could possibly contribute to better treatments for such patients in the future. The goal of the task may have been too vague, because participants did not know the reason why they needed to make movements as much as they could, or why disengage from the task. For this reason, participants may not have used their moods as an input to specific goal attainment. Further research is necessary with different physical tasks with relevant goals and tasks that are more relevant in daily life. Anyway, the present findings indicate that persistence on a physical task cannot entirely be explained by the fear avoidance model, as contextual factors such as motivational stop rule instructions and current mood explain an additional proportion of the variance in task performance. This suggest that despite the urge to stop this painful activity, these subjects were able to inhibit the primary goal to protect their body integrity by escaping early.

Despite is limitations, this study is the first to demonstrate that task performance is not only predicted by habitual pain-related fear, but also by contextual factors such as current mood and goals. Future studies might further examine the role of these contextual factors by refining goal priming instructions and stronger mood induction procedures.

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