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The role of affect in pacing: an experimental study

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Título: El papel de las emociones en el patrón de secuenciación de actividades: un estudio experimental.
Resumen: Las personas con dolor crónico cambian la forma de realizar las actividades cotidianas, diferenciándose diversos patrones, entre ellos, la secuenciación de actividades (*pacing*). La bibliografía acerca de la relación entre *pacing* y afecto muestran resultados contradictorios. El objetivo de este estudio fue contrastar experimentalmente, en una muestra de 145 estudiantes, si la inducción de afecto positivo vs negativo influía en la elección del tipo de "*pacing*" ("*pacing* para aumentar la productividad" y "*pacing* para reducir el dolor") cuando los participantes eran expuestos a dolor, controlando las variables optimismo y catastrofismo. Los resultados de la regresión logística multinomial no mostraron relación entre las variables. El *pacing* es una estrategia de intervención presente en todos los modelos de intervención en dolor crónico y, por tanto, es relevante seguir profundizando acerca del rol del afecto en relación al mismo.
Palabras claves: Afecto Positivo. Afecto Negativo. Optimismo. Catastrofismo. *Pacing*. Dolor.

Abstract: People with chronic pain often change the way they carry out their daily activities according to different patterns, among which are pacing strategies. Cross-sectional studies on the association between pacing and affect show contradictory results. The study aim was to experimentally test whether the induction of positive affect vs negative affect would influence the choice of the type of pacing (pacing to increase productivity or pacing to reduce pain) when the participants were exposed to pain, while controlling for the variables optimism and catastrophism. The study participants comprised a sample of 145 undergraduates. The results of multinomial logistic regression showed that there was no association between the variables. Pacing is an intervention strategy in all chronic pain intervention models, and thus it is relevant to continue investigating the role of affect in relation to pacing.
Keywords: Positive Affect. Negative Affect. Optimism. Catastrophism. Pacing. Pain.

Introduction

Chronic pain affects a large segment of the population. A study conducted in 16 European countries and Israel found that 19% of the adult population experienced chronic pain (Breivik et al., 2006). Another study conducted in the United States found a prevalence of 20% (Yong et al., 2022). In Spain, the figure is similar at 17% (Dueñas et al., 2015). It causes considerable suffering and disability (Burke et al., 2015) and those who live with it find it interferes in most spheres of life (work, home, leisure, etc.).

People affected by chronic pain change the ways they carry out their daily activities, which gives rise to various "activity patterns" (McCracken and Samuel, 2007), which are consistent ways of acting or performing daily tasks or functions (Bendixen et al., 2006). Activity patterns are implemented with the aim of decreasing pain, maximising functioning/activity level, or both (Racine et al., 2018), and are relevant to the development and perpetuation of chronic pain (Van Damme and Kindermans, 2015).

Traditionally, various activity patterns have been distinguished (McCracken and Samuel, 2007): avoidance, persistence, and pacing. The latter pattern is the specific focus of the present study. Nielson et al. (2014) described pacing as the regulation of activity levels, which is characterised by dividing daily activities into small steps, such that patients are able to progressively increase their activity periods without becoming tired. However, there is no universally accepted definition of this pattern (Gill and Brown, 2009), which may lead to inconsistent results regarding associations between pacing and adaptation in chronic pain patients (Cane et al., 2018).

Several studies have found positive correlations between pacing and high levels of disability and depressive symptomatology (Hadzic et al., 2017). A recent systematic review (Guy et al., 2019) found that although the pacing strategy does not reduce levels of perceived pain, it is associated with decreased joint stiffness and fatigue. Another recent study found that people who use this pattern have better adjustment to pain, greater psychological well-being, and have better daily functioning and job satisfaction (Guy et al., 2020). A positive association has been found between pacing and negative affect, whereas other studies have found a positive association between pacing and positive affect (Racine et al., 2018). Some authors have suggested that such inconsistent results could be explained by pacing being a multidimensional construct rather than a unidimensional one (Kindermans et al., 2011).

From a multidimensional perspective, three types of pacing can be distinguished depending on the motive behind the activity pattern: a) reducing pain; b) conserving energy for valued activities; and c) increasing overall productivity (Nielson et al., 2014). The type most commonly used is pacing to increase productivity by dividing tasks into small steps, followed by pacing to reduce pain, and then pacing to conserve energy (Antcliff et al., 2019). Suso-Rivera et al. (2021) found that only "pacing for pain reduction"—specifically at very high levels of pain—was significantly and positively associated with the presence of depressive symptoms. The authors concluded that the setting in which this behaviour occurs is relevant when the utility of such patterns is taken into account.

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Patients' engagement in pacing can be understood from a motivational point of view. When they use pacing to reduce pain, they are pursuing avoidance goals, whereas when they use pacing to conserve energy for valued activities or to increase productivity, they are pursuing approach goals (Esteve et al., 2018). Several studies have shown an association between positive affect and approach goals, and an association between negative affect and avoidance goals (Lyubomirsky et al., 2005). Positive emotions indicate that life is "going well" and, in these circumstances, individuals feel capable of achieving new goals and expanding their resources. However, the presence of negative affect is indicative of potential threats, which create a situation in which the main goal is to protect oneself from them in order to survive (Fredrickson, 1998).

Previous studies have obtained contradictory results regarding the relationship between specific pacing patterns and affect in different groups of patients with chronic musculoskeletal pain (Esteve et al., 2016; Esteve et al., 2017; Esteve et al., 2018). In 2016, we found that "pacing to increase productivity" and "pacing to conserve energy to perform other valued activities" were positively correlated with positive affect and negatively correlated with negative affect, whereas no relationship was found between "pacing to reduce pain" and positive or negative affect. We also found that "pacing to increase productivity" was not associated with positive or negative affect, and that "pacing to conserve energy" was positively associated with positive affect and negatively related to negative affect, although no association was found between "pacing as a way to reduce pain" and positive or negative affect (Esteve et al., 2017). In another study (Esteve et al. 2018), no association was found between "pacing to increase productivity levels" and "pacing to conserve energy" and positive or negative affect, a negative association was found between "pacing to reduce pain" and positive affect, and no association was found between "pacing to reduce pain" and negative affect.

In summary, from a multidimensional perspective, only correlational evidence is available on the relationship between affect and pacing and, to date, the results are contradictory (Esteve et al., 2016; Esteve et al., 2017; Esteve et al., 2018). Therefore, more experimental research—that goes beyond simple correlational studies—is needed to determine whether positive or negative affect influences the type of pacing that individuals perform to organise their activity when in pain.

In order to investigate this relationship, the role of optimism and catastrophism should be taken into account. On the one hand, optimism is a dispositional variable that makes individuals prone to experience positive affect (Hanssen et al., 2014). On the other hand, an association has been found between the tendency to make catastrophising interpretations of pain and the development of highly maladaptive thoughts and emotions that lead to greater perceived intensity of pain (Kapoor et al., 2015; Ramírez-Maestre et al., 2017).

The function of pacing in people with chronic pain is of particular relevance to researchers because the attempt to establish this activity pattern is one of the goals of the more traditional psychological interventions (Scott-Dempster et al., 2017). It has been found that 83% of therapists working with people with chronic pain teach them about this pattern (Antcliff et al., 2019): hence, its investigation is of relevance.

The aim of this study was to determine possible associations between experimentally-induced positive and negative affect and the way in which participants choose to experience experimentally-produced (cold-pressor) pain: a) by sequencing activity (pacing) to increase productivity; b) by sequencing activity (pacing) to reduce pain; and c) by facing pain induction without sequencing activity ("all-at-once"). Levels of optimism and catastrophism were controlled for their association with positive and negative affect, respectively (Hanssen et al., 2014; Kapoor et al., 2015).

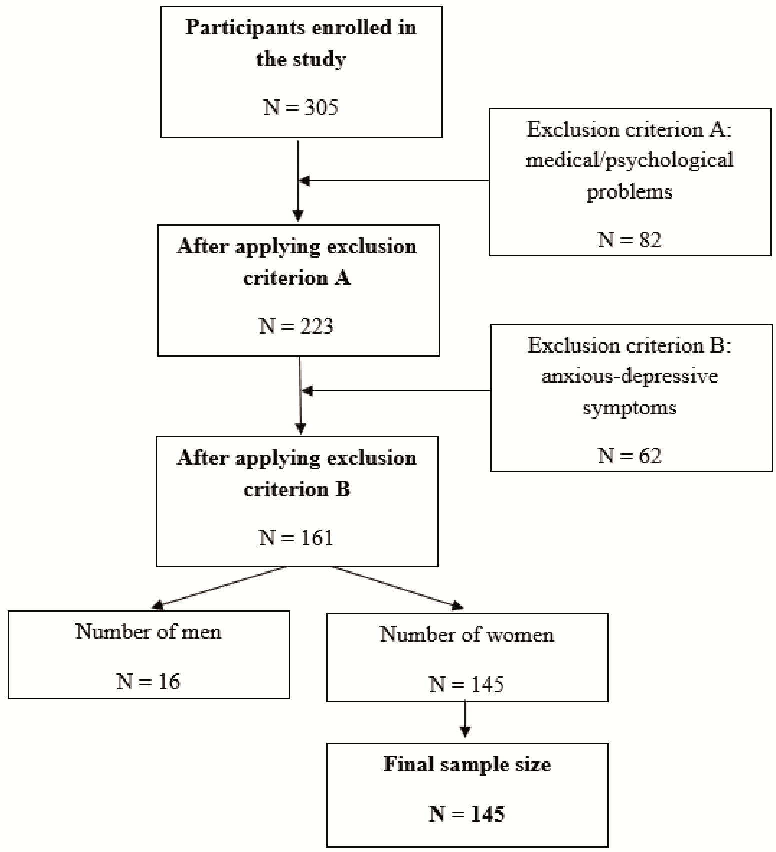
It is relevant to attempt to understand whether affect influences the choice of one type of pacing over another because the emotional state of patients may influence the function of pacing behaviour (i.e., avoidant or approach goals). Thus, two hypotheses were formulated based on an understanding that "pacing to reduce pain" implies an avoidance goal and "pacing to increase productivity" implies an approach goal: (a) participants performing a cold-pressor task who have been induced with positive affect will use the "pacing to increase productivity" strategy more frequently than those who have been induced with negative affect; and (b) participants who have been induced with negative affect will use the "pacing to reduce pain" strategy more frequently than those who have been induced with positive affect. The optimism and catastrophism variables were controlled for their association with positive affect and pain perception, respectively.

Method

Participants

Three hundred and five students from the Faculty of Psychology and Speech Therapy of the University of Málaga expressed interest in participating in the study. Inclusion criteria were as follows: a) being of legal age; and b) providing informed consent and accepting that their participation would not have any direct academic benefit. Exclusion criteria were as follows: a) having any diagnosed medical or psychological problems; and b) showing anxious or depressive symptoms: high levels of anxiety or depression could affect the induction of positive or negative affect. Based on the above criteria, 82 people were eliminated for medical problems (e.g. persistent pain) or psychological ones (e.g. eating disorders). A further 62 people were eliminated because they scored 11 or higher in depression and anxiety on the Hospital Anxiety and Depression Scale (HADS; Quintana et al., 2003). Due to the great disparity between the number of men (16 volunteers) and women (145 volunteers), we decided to include only female participants, because studies have suggested that men and women present different patterns of affective reaction to different emotional stimuli (Godinho et al., 2006). Figure 1 depicts the participant selection process.

Figure 1.
Sample selection flowchart



The final sample comprised 145 female psychology students. The mean age of the participants was 20.79 years (*SD* = 4.40), and 92% of them were single. The sample size was adequate for the objectives of the study. There should be 140 participants for the Student *t*-test to detect effects with a mean effect size (.30) at a significance level of .05 and a power of .80. The sample size for multinomial logistic regression was calculated following Freeman's (1987) classic formula [n = 10 * (k + 1)], which states that the sample size should be about ten times the number of independent variables plus one: in the present case, 40 individuals. Thus, the sample size (N = 145) was sufficient to detect any significant differences.

Variables and instruments

Anxiety and Depression. As mentioned, participants with high levels of anxiety and depression were excluded. The Spanish version (Quintana et al., 2003) of the HADS (Zigmund and Snaith, 1983) was used to measure these variables. It consists of a 4-point Likert-type scale with 14 items, 7 of which assess anxious symptoms and 7 assess depressive ones. The higher the score, the more symptoms. In this sample, the internal consistency of both subscales was high (anxiety, $\alpha = .86$; depression, $\alpha = .86$).

Dispositional Optimism. Dispositional optimism was used as a covariate in this study. Thus, we used the Spanish version (Chico et al., 2002) of the Life Orientation Test questionnaire (LOT-R; Scheier et al., 1994), which is a 5-point Likert scale with 10 items with scores ranging from 0 (strongly disagree) to 4 (strongly agree). The higher the scores, the higher the dispositional optimism. In this sample, the LOT-R total score showed high reliability ($\alpha = .90$), as did the optimism and pessimism subscales (.85 and .81, respectively).

Pain Catastrophising. The degree of pain catastrophising was also used as a covariate in this study and was assessed using the Spanish version of the Pain Catastrophising Scale (PCS; García-Campayo et al., 2008), a self-administered 13-item scale. Participants take their past painful experiences as a reference and indicate the degree to which they experience each of the 13 thoughts or feelings on a 5-point Likert-type scale, with scores ranging from 0 (Not at all) to 4 (Always). The higher the score, the higher the level of catastrophising. This instrument also demonstrated high internal consistency (α = .79) in this sample.

Induction of positive and negative affect. These affects were induced using the International Affective Picture System (IAPS; Lang et al., 2008), which contains a set of normative emotional stimuli that includes over 1000 pictures. This study used the normative data and images from the Spanish adaptation of the IAPS (Moltó et al., 1999; Moltó et al., 2013; Vila et al., 2001).

The evaluative judgements for each of the images were measured using the Self- Assessment Manikin (SAM; Lang, 1980). Participants were given a booklet in which they recorded the level of pleasure/displeasure (valence), level of activation (arousal), and level of control (dominance) elicited by each image (Rhudy et al., 2010). Each image had to be evaluated on these three dimensions on a 9-point Likert scale, with scores ranging from 1 ("minimum liking, minimum arousal, and minimum control") to 9 ("maximum liking, maximum arousal, and maximum control") (Moltó et al., 2013). In order to shorten the duration of the experiment, participants did not assess the dominance dimension. This dimension was also excluded because it has rarely been applied in pain studies that have used the IAPS: thus, it is of little theoretical interest. Each participant's ratings for all the images in these two dimensions were added to obtain the valence and arousal values. The IAPS has normative image data for all affective dimensions (valence, arousal, and dominance) (Vila et al., 2001).

Pain induction through cold water exposure. The cold-pressor task (Keogh et al., 2006) was used for pain induction. The apparatus used has two compartments, one containing water at room temperature (between 17°C and 20°C) and one containing cold water (between 4°C and 7°C). These temperature ranges were considered the most appropriate to produce longer-lasting and less intense pain, thus allowing participants to implement their chosen pain-exposure strategies (Dar and Leventhal, 1993; Sullivan et al., 1997).

Procedure

Creation of the two experimental conditions. We used the standardised procedure to create the two experimental conditions (induced positive affect vs induced negative affect) (Moltó et al., 2013). We created two presentations of 37 images taken from the Spanish adaptation of the IAPS (Moltó et al., 2013), one for the induction of positive affect and one for negative affect. According to previous studies, the number of images per experimental condition was sufficient to induce an emotional response in participants (Moltó et al., 1999; Vila et al., 2001). In order to avoid interfering with pain induction using cold water, we did not include images of a physical nature (wounds, etc.), because previous studies have shown that individuals report greater pain intensity when a painful stimulus is presented alongside images with human pain content (Godinho et al., 2006).

Photographs were selected according to the normative values provided by the IASP (Vila et al., 2001), with the aim of causing an intense emotional response. To induce positive and negative affect, we selected high-valence images (M = 7.55 and SD = .34) and low-valence images (M = 2.32 and SD = .32), respectively. The normative arousal level of both groups of images was matched to ensure that they elicited the same degree of arousal, (de Wied & Verbaten, 2001). Matching was tested using the Student t-test. The mean arousal level of the positive images was 6.36 (SD = .59), whereas the mean arousal level of the negative images was 6.43 (SD = .59; t = -.57; P = .96).

Participant recruitment. Firstly, we informed students in their classrooms about the aim of the study. Those interested in participating filled in the informed consent form, gave their personal data and information regarding the exclusion criteria, and completed the LOT-R (Chico et al., 2002), the PCS (García-Campayo et al., 2008), and the HADS (Quintana, et al., 2003). After analysing this information, we eliminated students meeting any of the exclusion criteria and contacted those meeting the inclusion criteria by telephone to complete the experimental part of the study. Two pilot trials of the experimental procedure were conducted to ensure that the instructions had been correctly understood by the participants. Once the experimental procedure had been refined, a software application was used to randomly assign participants to each experimental condition (induction of positive affect or induction of negative affect).

Experimental procedure. The participants entered the laboratory, each being randomly assigned to one of the two experimental groups (positive vs. negative affect), and the experimental procedure began with emotional induction using the IAPS (Moltó et al., 2013). Slides were projected onto a screen with the task instructions presented visually and audibly as well as the 37 images, thus ensuring greater uniformity in the experimental procedure. The participants were given a booklet in which they evaluated the images by recording the level of valence and the degree of arousal elicited by each of the images (Rhudy et al., 2010).

Once the emotional response was induced, participants were subjected to cold-pressor pain induction (Keogh et al., 2006). Firstly, the participants placed their non-dominant hand in the room-temperature water compartment for 5 minutes to equalise hand-temperature across all individuals. At this point, they were given instructions through a video and audio presentation in which they were instructed to choose how they wanted to expose themselves to the cold-pressor task afterwards. To differentiate between the two types of pacing in each experimental group, participants were randomly subdivided into two subgroups: (a) half of the participants were offered the choice of performing the task "step-by-step", with the motivation that it might hurt less ("pacing to reduce pain"), or they could choose to perform the task "all-at-once"; (b) the remaining half were offered the choice of performing the task "step-by-step", with the motivation that they might endure for a longer overall time ("pacing to increase productivity"), or they could choose to do it "all-at-once".

When participants decided to stage their pain exposure by choosing either of the pacing conditions, they held their hand in the cold water intermittently: 20 seconds of immersion followed by 10 seconds out of the container. The researchers announced the start and end of these exposure periods. In all conditions (pacing or "all-at-once"), they were instructed that they could end the procedure at any moment ("they could take their hand out of the cold water whenever they wished to do so") (Edens and Gil, 1995). Total immersion time was measured.

Statistical analysis

Descriptive analyses. Descriptive analyses (means, standard deviations, and Pearson correlations) were conducted for continuous variables, all of which met the assumption of normality using the Kolmogorov-Smirnov test.

Analyses of the experimental control. Firstly, we determined whether the experimental manipulation had been effective in the experimental groups by comparing the means of the level of valence and arousal reported by both groups when viewing the images. In addition, homogeneity between experimental groups was investigated by testing for significant differences between them. Next, we tested differences between groups in the covariates catastrophism and optimism. These differences were ascertained using the Student *t*-test.

The contingency coefficient was applied to establish whether the researchers had influenced the way in which the participants had chosen to expose themselves to pain ("pacing to increase productivity" vs "pacing to reduce pain" vs "all-at-once").

Testing the main hypothesis. We counted the number of participants who had chosen each pain-exposure strategy according to the experimental condition. A multinomial logistic regression was performed, which allowed us to use categorical predictors (in our case, the independent variable positive affect vs negative affect) together with continuous covariates (optimism and catastrophism) to determine membership in more than two categories: "pacing to increase productivity" vs "pacing to reduce pain" vs "all-at-once". In all analyses, "all-at-once" was used as the reference category (i.e. the category to which the other two were compared). The regression coefficients could not be directly interpreted due to the lack of a linear distribution. Therefore, the coefficients were transformed into incidence rate ratios (IRRs) by calculating their exponentials (i.e., eβ). IRRs describe the magnitude of change in the number of expected observations of the dependent variable when the independent variables change by one unit. For example, if the IRR of a variable is .70 then the expected number of observations of the dependent variable would change by .70 if the independent variable changes by one unit. To achieve a parsimonious and robust model, we first tested univariate associations between each of the predictor variables and the dependent variable and only those that showed a significant correlation were entered into the multivariate model (Ato-García and López-García, 1996). The data were analysed using SPSS 22 software (SPSS; Chicago, IL, USA).

Results

Descriptive analyses

Table 1 shows the means, standard deviations, and Pearson correlations for each of the variables. For the total study sample, significant negative correlations were found between the level of valence and self-reported arousal—such that the higher the valence, the lower the arousal—and between levels of optimism and catastrophism.

Table 1
Description of continuous variables. Means, standard deviations, and Pearson correlations.

Variables	Range	Mean (SD)	2	3	4
1. Valence	44- 322	173.26 (77.19)	-.24**	.02	-.05
2. Arousal	42-281	178.35 (62.22)	---	.03	.10
3. Optimism	4-24	14.63 (4.29)		---	-.25**
4. Catastrophism	13-51	25.78 (7.51)			---

Note. $^{**}p < .01$

Analyses of the experimental control

The results showed a significantly higher mean valence in the induced positive-affect group than in the induced negative-affect group. However, there was significantly higher arousal in the induced negative-affect group than in the induced positive-affect group. No significant differences were found between the two experimental groups (see Table 2) regarding anxious or depressive symptoms or the levels of the covariates (optimism and catastrophism).

Table 2
Analysis of differences between the experimental groups (positive vs negative affect) in the study variables.

Variable	Positive affect		Negative affect		*t*	*p*
	Mean	*SD*	*Mean*	*SD*		
Valence	246.27	27.39	103.22	29.61	-30.16	.001
Arousal	163.97	61.59	192.15	60.06	2.79	.006
Anxiety	6.98	3.11	7.39	2.83	.823	.412
Depression	2.97	2.31	3.19	2.17	.585	.559
Catastrophism	25.44	7.87	26.12	7.20	.547	.585
Optimism	14.65	4.37	14.62	4.24	-.037	.971

Note. SD: standard deviation.

Finally, no significant associations were found between the participants' choice of pain exposure (i.e., "pacing to reduce pain", "pacing to increase productivity", or "all-at-once") (C = .05, *P* = .829) and which of the researchers had conducted the experiment.

Testing the main hypothesis

Table 3 shows the number of participants who chose each strategy to manage pain exposure by experimental group. Of the total number of participants, 65.52% (N = 95) chose the "all at once" option, regardless of the type of emotion induced. Of the participants who chose pacing (N = 50), 54% (N = 27) chose "pacing to reduce pain" and 46% (N = 23) chose "pacing to increase productivity", with similar distributions across the experimental groups.

Table 3
Classification of participants' choice by experimental group (induction of positive vs negative affect).

Participants' choice	Experimental group		Total
	Positive affect	Negative affect	
Pacing to reduce pain	10	17	27
Pacing to increase productivity	13	10	23
All-at-once	48	47	95
Total	71	74	145

In contrast to the formulated hypothesis, the results of the multinomial regression show that the type of affect induced in the participants did not significantly predict the participants' choice of strategy towards pain exposure (see Table 4). Similarly, no correlation was found between the covariates (optimism and catastrophism) and the participants' choices.

Table 4
Multinomial regressions. Associations between emotional induction (positive vs negative affect), optimism, and catastrophising and the participants' choice of pain exposure strategy.

	Pacing to increase productivity			Pacing to reduce pain		
Predictors	IRR	CI	*P*	IRR	IC	*P*
Affect	.786	.314 - 1.966	.606	1.736	.721-4.180	.218
Optimism	.924	.831 - 1.026	.140	.999	.902 - 1.105	.981
Catastrophism	1.050	.989 - 1.116	.111	1.027	.969-1.087	.370

Note. The reference category is "all-at-once". IRR: Incidence rate ratios; CI: confidence interval.

Discussion

The main objective of this study was to determine whether positive and negative affect influence the choice of type of pacing ("pacing to increase productivity" and "pacing to reduce pain") when participants undergo a cold-pressor procedure. Given that "pacing to reduce pain" implies an avoidance goal and "pacing to increase productivity" implies an approach goal, we postulated that the "pacing to increase productivity" strategy would be more often chosen by participants who had been induced with positive affect than by those who had been induced with negative affect. By contrast, we postulated that the "pacing to reduce pain" strategy would be more often chosen by those who had been induced with negative affect than by those who had been induced with positive affect. Levels of optimism and catastrophism were controlled for their association with positive and negative affect, respectively (Kapoor et al., 2015). The results on the association between positive and negative affect and pacing contradict those obtained in cross-sectional studies that have treated the construct as unidimensional (e.g., Racine et al., 2018) or multidimensional (e.g., Esteve et al., 2018).

The results showed that the induction of positive or negative affect did not influence the participants' choice of type of pacing. Most of the participants chose the "all-at-once" option rather than choosing a pacing strategy, regardless of the type of induced affect. Furthermore, neither optimism nor catastrophism significantly predicted the participants' choice of how to experience pain.

As expected, although significant differences were found between the two experimental groups in valence, the emotional induction may have been too weak to influence the participants' choice regarding their mode of pain exposure. It should be noted that, although the IAPS (Lang et al., 2008) is a reliable, valid, and robust tool, after completing the experimental procedure some participants spontaneously stated that some of the images were outdated. This response suggests that the IAPS may have had a slightly reduced effect due to aspects related to the participants' mean age. Future research could use other emotional induction methods, such as music with instruction-guided imagination (Blood and Zatorre, 2001).

On the other hand, in a study conducted with women with fibromyalgia, Ecija et al. (2021) found that pain acceptance had a moderating effect between the level of catastrophising and pacing. Specifically, at low levels of pain acceptance, significant positive correlations were found between catastrophising and pacing. However, at high levels of pain acceptance, pacing was independent of catastrophising. The authors concluded that low pain acceptance was associated with catastrophising-driven pacing regardless of goal. However, chronic pain patients with high pain acceptance may use pacing as a regulating mechanism to stay in line with their life goals. The study suggested that other variables, such as pain acceptance, may be involved in the initiation of pacing and the type of pacing. Thus, other variables, like pain acceptance, may mediate or moderate the choice of types of pacing that were not considered in our study.

It should be noted that this is the first study in this field to conduct a procedure to reproduce such activity patterns in an experimental setting. The instructions may not have been sufficiently long or detailed for the participants to fully grasp the meaning of the different options, despite the instructions being fine-tuned in the pilot study. Future experimental research should consider this possibility. As in previous studies (e.g., Masedo and Esteve, 2007), the effect of the instructions could be strengthened by first inducing pain, then giving the instructions on the choice of tasks, and finally asking participants to make a choice during a second pain induction period.

The absence of significant results may be related to the experimental design. The hypothesis was that there would be associations between the "pacing to increase productivity" pattern and approach goals, and associations between the "pacing to reduce pain" pattern and avoidance goals. It may be the case that the choice to expose oneself to the "all-at-once" pattern, as described in the instructions, was understood by the participants as being linked to approach goals. Furthermore, most of the participants may have chosen to expose themselves to the cold-pressor task without pacing because they communicated with each other despite having been asked not to do so. This might have lead to a type of "contagion" in which this particular choice may have been perceived as a challenge to be confronted. This effect could be controlled for in future experiments by choosing participants pursuing different degrees in geographically separate study centres to hinder communication. This could be achieved by recruiting through social networks rather than in classrooms.

One limitation of the study is that all participants were women and therefore the results cannot be generalised to both sexes. Secondly, significant differences in mean arousal were found in both experimental groups, despite the fact that according to normative data and as tested a priori, there were no differences between positive and negative affect-inducing images.

As noted, future research could refine the experimental procedure. Experimental research into other types of activity patterns is of interest, such as persistence and its relationship with other motivational variables (e.g., goal management strategies) (Esteve et al., 2016; Esteve et al., 2017; Esteve et al., 2018) and the Behavioural Inhibition Systems (BIS) and Behavioural Activation Systems (BAS) (Serrano-Ibáñez et al., 2018). These are two fundamental brain systems that are activated automatically, and relatively independently, by environmental or internal stimuli, such as pain. Thus, differences in the reactivity of these systems may influence how people behave, making individuals more likely to pursue approach goals (in the case of high BAS sensitivity) or avoidance goals (in the case of high BIS sensitivity). Therefore, these could be relevant to the choice of participants in future experiments.

The results of this experimental study show that affect does not have a significant influence on the type of pacing chosen to cope with pain experience. However, pacing is a strategy used in most chronic pain intervention models, and thus interventions to enhance the effectiveness of pacing by inducing positive emotional states remains a topic of interest of future research (Proyer et al., 2016).

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