Supplement

Supplementary analysis

For this supplementary analysis n=6 participants from a corresponding pilot trial have been included in order to increase statistical power. Importantly, the experimental procedures including pain stimulation have been identical in both trials. However, within this pilot trial, another version of the visual analogue scale training had been used. This extended analysis revealed a significantly impaired recognition performance (d') for the visceral pain condition (β = 0.74 ± 0.19 [95% CI 0.37-1.12]) compared to the thermal pain condition (β = 0.89 ± 0.17 [95% CI 0.54-1.23]) with medium effect sizes (t(69.0) = -2.24, p = 0.029, d = -0.54). There were no significant differences in d' between the control condition and both pain conditions. This additional analysis strengthens the conclusions drawn from the original sample (N=30).

As suggested during the review process, we provide exploratory analyses to explore additional putative modulators hoping to inspire future research in this direction and to provide the reader with maximal transparency and insight into inter-individual variability in our dataset.

First, we stratified our samply by sex as requested during the review process (Fig. S4A and S4B). On a descriptive level, men showed a greater decrease in recognition performance in the visceral pain condition compared to women, which was not supported by the statistical analyses (all p > 0.3). This observation has to be interpreted with great caution considering the unequal distribution of sex (N_{male}=7, N_{female}=23) in our sample. To investigate potential sex differences, a larger and stratified sample is required. This was, however, not the aim of our study but is without doubt a highly relevant question to be addressed in future, larger-scale studies.

Second, we stratified by unpleasantness ratings (Fig. S5A and S5B), given our previous work highlighting the crucial role of pain unpleasantness in the context of different pain modalities. Specifically, when splitting the sample into subgroups with respect to mean unpleasantness ratings during image encoding, i.e., one subgroup having rated visceral pain more unpleasant than somatic pain and one subgroup with vice versa ratings, it seems as if the interruptive function of visceral vs. somatic pain is more pronounced, regardless of their relative unpleasantness, which is in line with our statistical analysis as described in the manuscript.

Finally, we explored the data, i.e., d' values (= recognition performance) of each condition, to identify potential predictors of the interruptive function of visceral compared to somatic pain. Therefore, we split the sample into two subgroups depending on their d' values: One subgroup (see Tab. S1, A) with higher d' values in the somatic compared to the visceral pain condition, and one subgroup (see Tab. S1, B) with higher d' values in the visceral compared to the somatic pain condition. However, we did not observe any differences comparing both subgroups regarding behavioral variables (e.g., depressive symptoms, anxiety, age, pain catastrophizing). Again, this observation has to be interpreted with great caution due to the inequality in participant distribution ($N_{d' | som>visc}$ = 22, $N_{d' | som<visc}$ = 8).

We hope that these supplementary analyses, additional figures and tables provide more insights into the data and may inspire future larger scale investigations into interindividual variability and analyses approaches to explore moderators and subgroups.

Instructions and information for participants

Unpleasantness instruction and training of visual analogue scale ratings according to Price et al. [1], which has been provided immediately prior to the experiment by one of the investigators:

> "There are two aspects of pain which we are interested in measuring: the intensity - how strong the pain feels- and the unpleasantness - how unpleasant or disturbing the pain is for you. The distinction between these two aspects of pain might be made clearer if you think of listening to a sound, such as a radio. As the volume of the sound increases, I can ask you how loud it sounds or how unpleasant it is to hear it. The intensity of pain is like loudness; the unpleasantness of pain depends not only on intensity but also on other factors which may affect you. There are scales for measuring each of these two aspects of pain. Although some pain sensations may be equally intense and unpleasant, we would like you to judge the two aspects independently. Please use the marker on the screen to indicate the relative intensity of your pain sensation; the further to the right, the greater the intensity. Similarly, mark the second dotted line to indicate the relative unpleasantness of your pain sensation."

Kindly note that after insertion of the rectal distension catheter by a trained physician (J. K.-B.) and prior to the calibration procedure, all participants have been informed about a potential feeling of urge to defecate, which might occur during a rectal distension, by the physician.
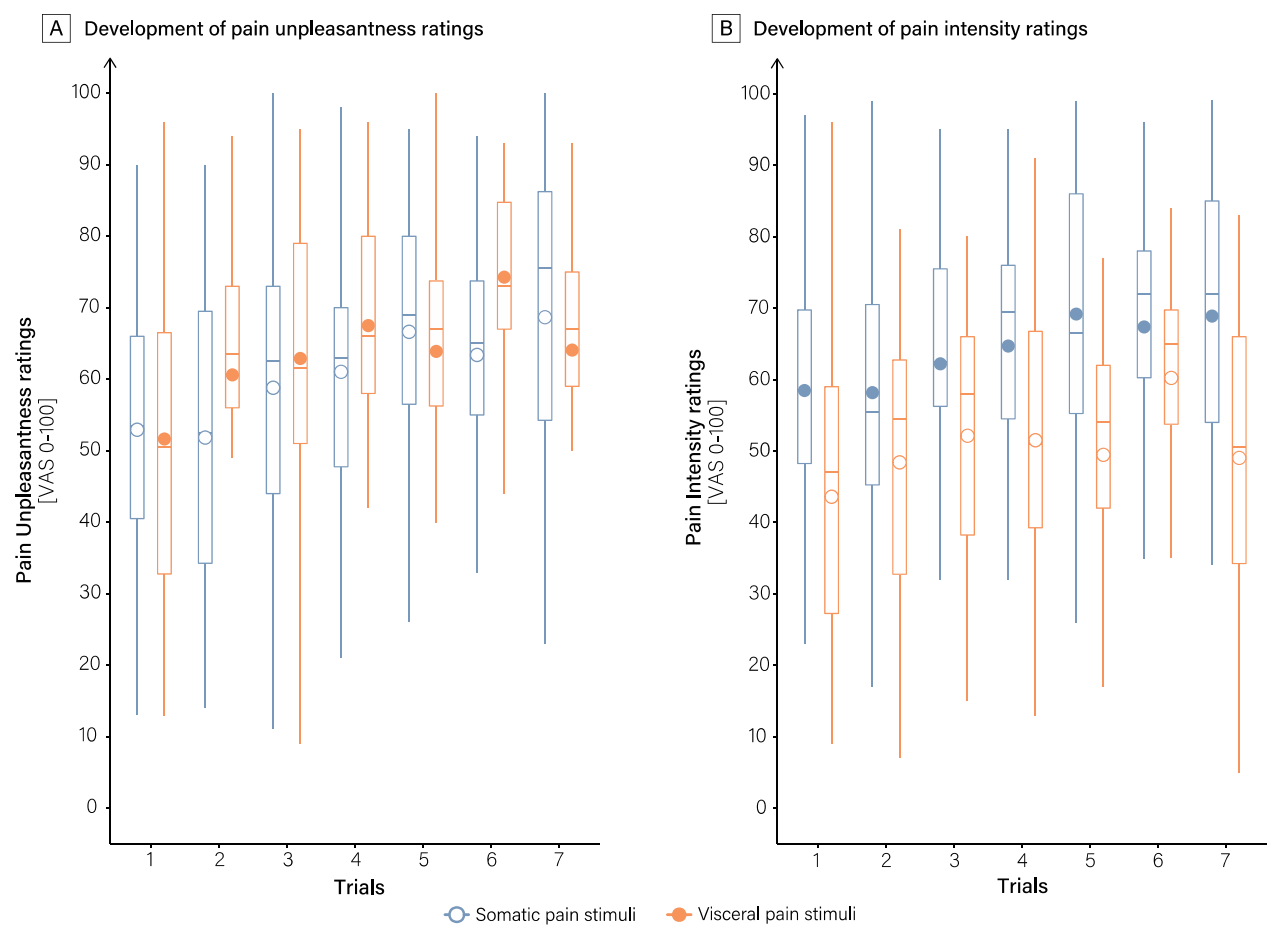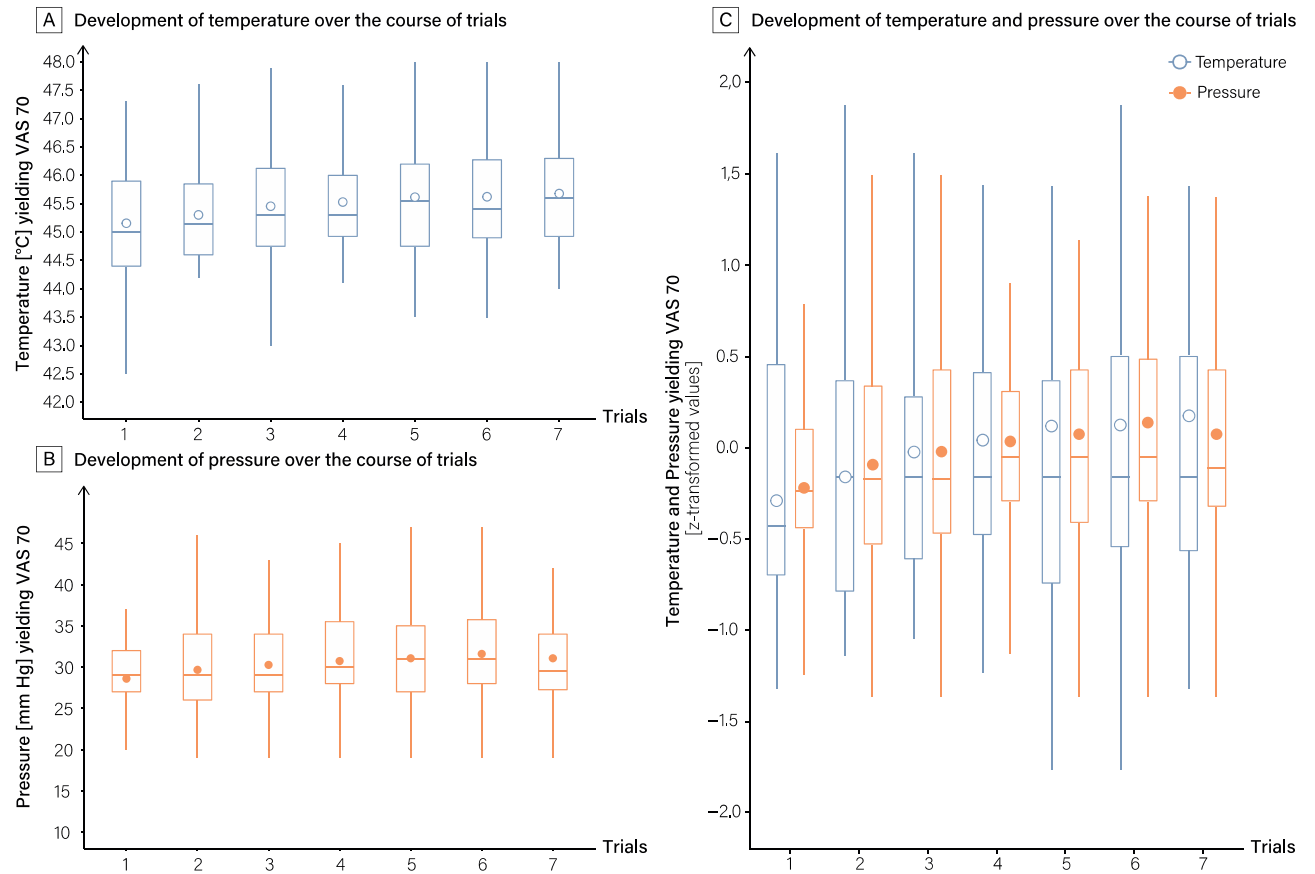
Supplementary tables

Table S1

	Subgroup A d'somatic ≥ d'visceral N=22		Subgroup B d'somatic < d'visceral N=8	
	mean	**sd**	**mean**	**sd**
Age (in yrs)	26,18	9,96	24,88	5,03
Depressivity (CES-D) score	4,59	6,10	3,88	3,60
Pain Catastrophizing (PCS) score	9,59	9,06	15,88	10,40
Unpleasantness ratings				
Mean unpleasantness rating during somatic pain	59,65	12,03	62,73	4,81
Mean unpleasantness rating during visceral pain	62,98	9,40	65,13	4,89
Mean unpleasantness rating during no pain	11,14	16,21	8,02	6,85
Pain Anxiety Symptoms Scale (PASS)				
Fearful appraisal of pain score	1,61	1,12	2,00	1,10
Cognitive anxiety score	1,47	0,89	1,60	1,11
Physiological anxiety score	0,39	0,52	0,88	0,83
Escape and avoidance behavior score	0,67	0,45	0,76	0,63
State Trait Anxiety Depression Inventory (STADI)				
State anxiety score	14,09	3,91	12,88	2,42
State depression score	16,73	3,24	17,00	2,45
Trait anxiety score	15.23	4.92	19.12	5.28
Trait depression score	15.91	3.74	15.38	3.70
Recognition performance parameters				
Correct hits in no pain condition (in %)	62,55	14,19	63,69	14,60
Correct hits in somatic pain condition (in %)	67,74	13,05	52,38	11,38
Correct hits in visceral pain condition (in %)	57,79	12,92	64,28	10,49
False alarm rate	0,36	0,14	0,30	0,11
dprime in no pain condition	0,73	0,45	0,92	0,46
dprime in somatic pain condition	0,88	0,44	0,62	0,36
dprime in visceral pain condition	0,58	0,45	0,94	0,39

For exploratory reasons, all participants (N=30) have been divided into two subgroups according to their recognition performance: A) participants showing higher or equal performance during somatic (i.e., thermal) compared to visceral pain (N=22), and B) participants showing higher performance during visceral compared to somatic pain (N=8).
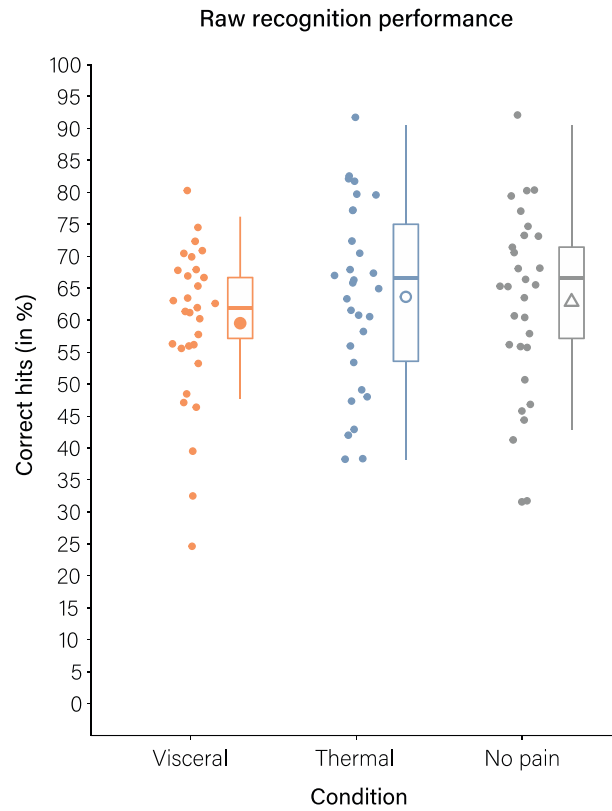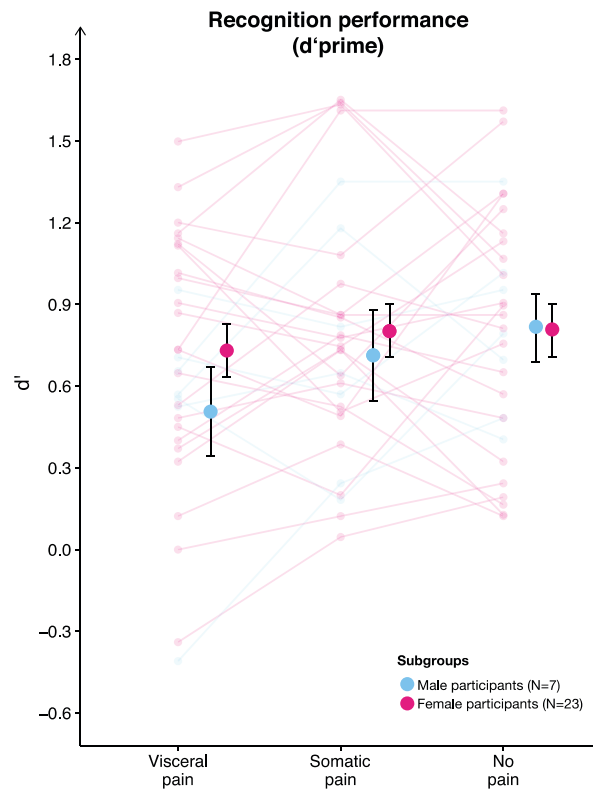
Supplementary figures

Figure S1. Development of pain unpleasantness (A) and pain intensity (B) ratings for somatic and visceral pain stimuli over the course of the categorization task. Displayed are boxplots and means (dots).
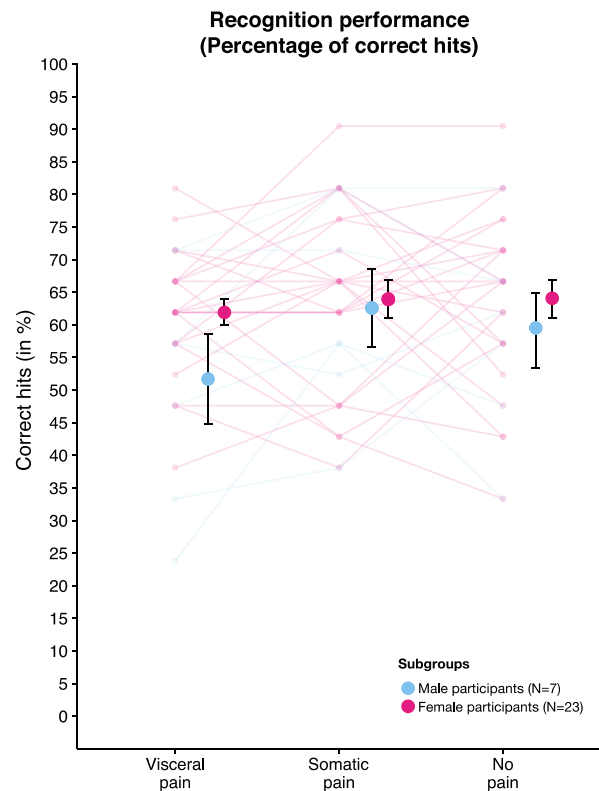
Figure S2. Development of temperature (A) and pressure (B) and z-transformed values of temperature and pressure (C) over the course of the categorization trials. Displayed are boxplots and means (dots).
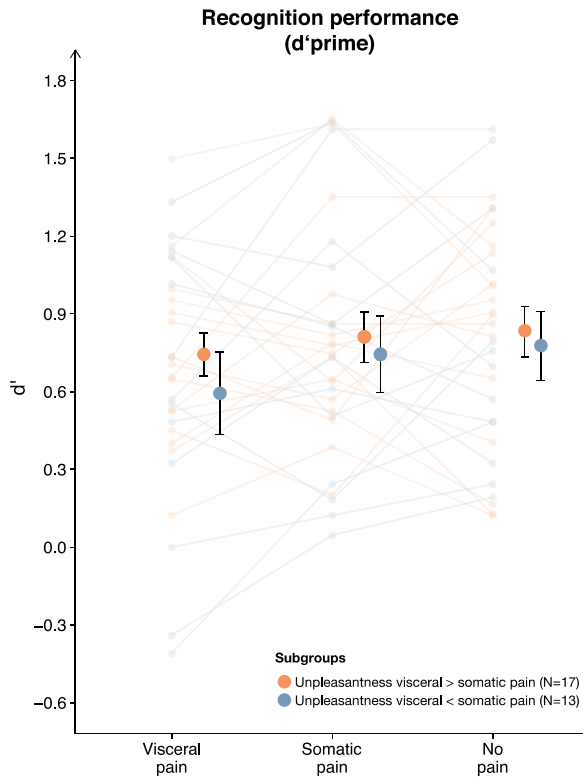
Figure S3. Raw recognition performance (percentage of correct hits) for the three experimental conditions. Displayed are boxplots and means of the raw data. Dots display single subject data.
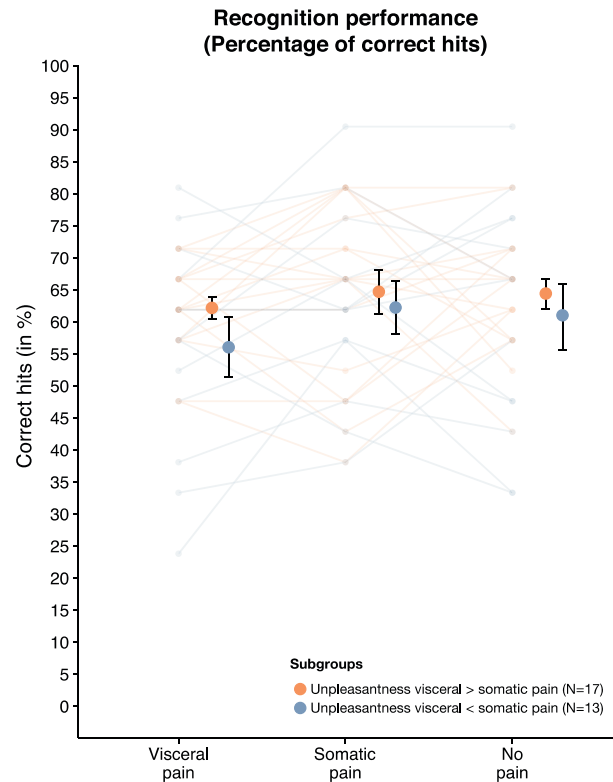
Figure S4A. Recognition performance (d') for the three experimental conditions for **female and male** participants separately. Displayed are means ± standard error of the mean. A single dot represents individual participant data, which is connected by a line per participant.

Figure S4B. Raw recognition performance (i.e., percentage of correct hits) for the three experimental conditions for **female and male** participants separately. Displayed are means ± standard error of the mean. A single dot represents individual participant data, which is connected by a line per participant.

Recognition performance (d'prime)

Recognition performance (Percentage of correct hits)

Figure S5A. Recognition performance (d') for the three experimental conditions. Participants have been split into two subgroups according to their **mean unpleasantness ratings**: i) higher ratings for visceral compared to somatic (i.e., thermal) pain and ii) vice versa. Displayed are means ± standard error of the mean. A single dot represents individual participant data, which is connected by a line per participant.

Figure S5B. Raw recognition performance (i.e., percentage of correct hits) for the three experimental conditions. Participants have been split into two subgroups according to their **mean unpleasantness ratings**: i) higher ratings for visceral compared to somatic (i.e., thermal) pain and ii) vice versa. Displayed are means ± standard error of the mean. A single dot represents individual participant data, which is connected by a line per participant.

References

[1]   Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. Pain 1983;17:45–56. doi:10.1016/0304-3959(83)90126-4.