

Supplementary Material B

In the experimental condition, interoceptive tactile stimulation was delivered in fixed time intervals randomly presented in 6 blocks. Each block was composed of 6 stimuli of 8s, 10s, 12s, 14s, 16s, and 18s. Each stimulus was followed by a 6s pause. The entire duration of the stimulation was approximately 11 minutes. The identical procedure was followed for the control condition with static pressure stimuli. Fig.1

Stimulation procedure

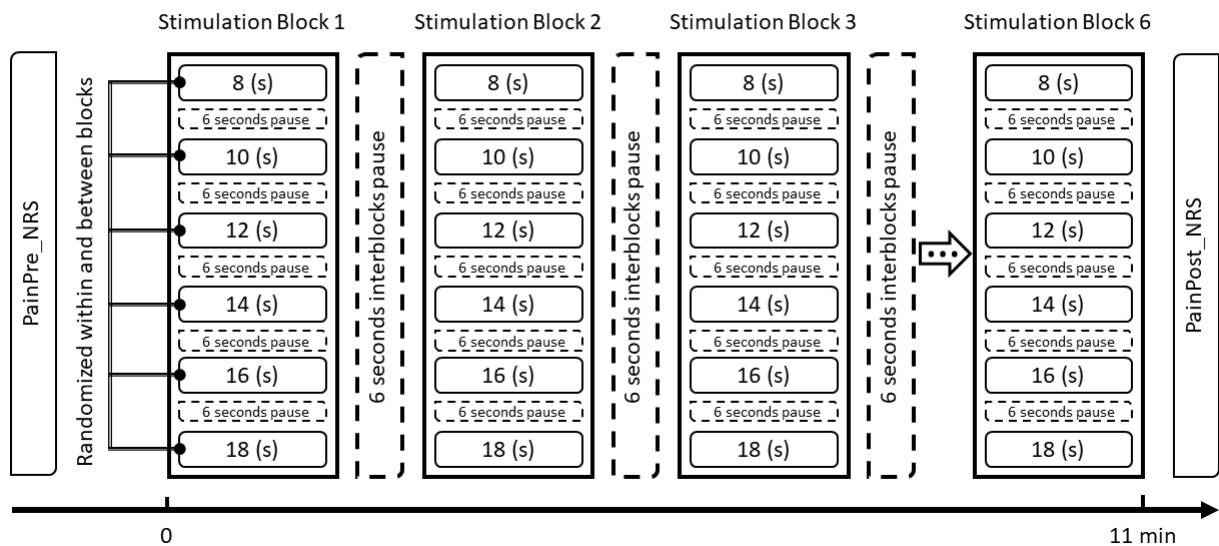


Figure. 1. Stimulation procedure.

Study 2. Supplementary Statistics

Below are descriptive statistics for the chronic pain sample and the results of an ANOVAs that shows the effects of the interoceptive stimulation as a method for pain analgesia. 2x2 ANOVA with factors Time (pre and post-stimulation) and Condition (Experimental and Control). Additional analyses are provided controlling for relevant covariates: Age, Body Mass Index (BMI), Duration in years of the pathology (PainYrs), Depression (BDI), State Anxiety (STAI_S), Interoceptive Cardiac Accuracy (IAcc), Interoceptive Confidence (IAconf).

Descriptive Statistics : Control (0) and Experimental (1) group

Descriptive Statistics

	Age		BMI		Pain_Yrs		PainPre_NRS		PainPost_NRS		Pain_Reduction	
	0	1	0	1	0	1	0	1	0	1	0	1
N	25	24	25	24	25	24	25	24	25	24	25	24
Mean	58.520	57.292	24.149	23.647	8.540	12.417	5.520	4.250	5.560	3.292	0.040	-0.958
Std. Deviation	16.003	13.027	4.661	4.048	7.402	7.518	2.220	2.132	2.329	2.274	0.889	1.268
Minimum	31.000	31.000	15.623	16.233	1.000	1.000	1.000	2.000	1.000	0.000	-3.000	-3.000
Maximum	79.000	81.000	31.862	29.737	30.000	20.000	10.000	8.000	10.000	7.000	2.000	2.000

	IAcc		IAconf		BDI		STAI_S	
	0	1	0	1	0	1	0	1
N	25	24	25	24	25	24	24	24
Mean	0.358	0.353	36.533	29.750	21.440	14.542	46.333	38.000
Std. Deviation	0.304	0.359	29.945	30.038	11.015	10.134	14.315	10.799
Minimum	0.000	0.000	0.000	0.000	3.000	0.000	28.000	20.000
Maximum	0.964	0.975	84.333	92.667	48.000	41.000	76.000	68.000

Frequencies for Pain_rcd: 1 SMP, 2 PP, 3 NP

Condition	Pain_rcd	Frequency	Percent	Valid Percent	Cumulative Percent
0	1	5	20.000	20.000	20.000
	2	10	40.000	40.000	60.000
	3	10	40.000	40.000	100.000
	Total	25	100.000		
1	1	8	33.333	33.333	33.333
	2	9	37.500	37.500	70.833
	3	7	29.167	29.167	100.000
	Total	24	100.000		

SMP: secondary musculoskeletal pain, PP: primary pain, NP: neuropathic pain

Supplementary analyses.

To evaluate the effect of the stimulation on chronic pain, we performed an RM ANOVA with factor Time (PainPre_NRS and PainPost_NRS) and factor group (Control = 0 and Experimental = 1). Assumptions were satisfied. Post-hoc comparisons used Bonferroni correction to evaluate significant results. Furthermore, to investigate the effect of possible confounding variables, we performed several additional RM ANOVAs controlling for all relevant covariates such as age, BMI, IAcc, IAconf, BDI, and STAI_S. Calculations were performed in Jasp 0.11.

Results Study 2

Pain reduction after interoceptive tactile stimulation

ANOVA showed a significant main effect of Time [$F(1, 47) = 8.68$, $p = 0.005$, $\eta_p^2 = 0.156$]. More importantly, the interaction effect of Time x Condition was highly significant [$F(1,47) = 10.26$, $p = 0.002$, $\eta_p^2 = 0.18$]. Post hoc analyses, with Bonferroni correction, indicated that the main effect was driven entirely by the Experimental group who received the interoceptive stimulation. They reported a significant reduction in pain [Mean Difference = -0.96, $SE = 0.22$, $t = -4.30$, $p_b < .001$, Cohen's $d = -0.61$] between before [Mean = 4.25, $SD = 2.13$] and after stimulation [Mean = 3.29, $SD = 2.27$]. By contrast, no significant difference in pain [Mean Difference = 0.04, $SE = 0.22$, $t = 0.183$, $p_b = 1.00$, Cohen's $d = 0.03$] was reported in the Control group between before [Mean = 5.52, $SD = 2.22$] and after the stimulation [Mean = 5.56, $SD = 2.33$]. No significant difference was found in pain at the baseline between the Control and Experimental groups [Mean Difference = 1.27, $SE = 0.64$, $t = 1.984$, $p_b = 0.315$, Cohen's $d = 0.283$]. These results are illustrated in Fig. 6.

We performed several additional RM ANOVAs to assess the effects of relevant covariates. The results remained significant after controlling for the following covariates: demographics [Age $p = 0.23$, BMI $p = 0.43$]; mood [BDI $p = 0.87$, STAI_S $p = 0.26$]. Interestingly, neither of the interoceptive variables [IAc $p = 0.96$, IAw $p = 0.68$] had any significant effect on pain reduction

Repeated Measures ANOVA

Within Subjects Effects

	Sphericity Correction	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_g	ω^2
Time	None	5.163	1.000	5.163	8.680	0.005	13.902	0.009	0.156	0.011	0.009
	Greenhouse-Geisser	5.163	1.000	5.163	8.680	0.005	13.902	0.009	0.156	0.011	0.009
	Huynh-Feldt	5.163	1.000	5.163	8.680	0.005	13.902	0.009	0.156	0.011	0.009
Time * Condition	None	6.102	1.000	6.102	10.258	0.002	25.027	0.011	0.179	0.013	0.011
	Greenhouse-Geisser	6.102	1.000	6.102	10.258	0.002	25.027	0.011	0.179	0.013	0.011
	Huynh-Feldt	6.102	1.000	6.102	10.258	0.002	25.027	0.011	0.179	0.013	0.011
Residual	None	27.959	47.000	0.595							

Within Subjects Effects

	Sphericity Correction	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
	Greenhouse-Geisser	27.959	47.000	0.595							
	Huynh-Feldt	27.959	47.000	0.595							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Between Subjects Effects

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Condition	76.652	1	76.652	8.116	0.006	11.250	0.147	0.147	0.140	0.127
Residual	443.899	47	9.445							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

1.1.1 Assumption Checks**Test of Sphericity**

	Mauchly's W	Approx. X^2	df	p	VS-MPR	Greenhouse-Geisser ϵ	Huynh-Feldt ϵ	Lower Bound ϵ
Time	1.000 ^a	NaN ^a	NaN ^a	NaN ^a	1.000	1.000 ^a	1.000 ^a	1.000 ^a

^a Singular error SSP matrix: The repeated measure has only two levels, or more levels than observations. When the repeated measure has two levels, the assumption of sphericity is always met.

Test for Equality of Variances (Levene's)

	F	df1	df2	p	VS-MPR
PainPre_NRS	0.137	1.000	47.000	0.713	1.000
PainPost_NRS	0.090	1.000	47.000	0.766	1.000

1.1.2 Post Hoc Tests**Post Hoc Comparisons - Time * Condition**

		95% CI of Mean Difference			SE	t	Cohen's d	p bonf	p tukey
Mean Difference		Lower	Upper						
Post,0	Post,1	2.268	0.513	4.023	0.640	3.543	0.506	0.005	0.005
	Pre,0	0.040	-0.561	0.641	0.218	0.183	0.026	1.000	0.998
	Pre,1	1.310	-0.445	3.065	0.640	2.046	0.292	0.274	0.184
Post,1	Pre,0	-2.228	-3.983	-0.473	0.640	-3.480	-0.497	0.006	0.005
	Pre,1	-0.958	-1.572	-0.345	0.223	-4.304	-0.615	< .001	< .001
Pre,0	Pre,1	1.270	-0.485	3.025	0.640	1.984	0.283	0.315	0.207

Note. Cohen's d does not correct for multiple comparisons.

Note. Bonferroni adjusted confidence intervals.

Repeated Measures ANOVA / factor clinical cluster**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	η^2	η^2_p
Time	4.593	1	4.593	7.332	0.010	0.008	0.146
Time * Condition	6.069	1	6.069	9.688	0.003	0.011	0.184
Time * Clinical_Cluster	0.533	2	0.267	0.426	0.656	0.001	0.019

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2	η^2_p
Time * Condition * Clinical_Cluster	0.407	2	0.204	0.325	0.724	0.001	0.015
Residual	26.937	43	0.626				

Note. Type III Sum of Squares

Between Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2	η^2_p
Condition	82.082	1	82.082	10.766	0.002	0.160	0.200
Clinical_Cluster	80.290	2	40.145	5.265	0.009	0.156	0.197
Condition * Clinical_Cluster	23.509	2	11.755	1.542	0.226	0.046	0.067
Residual	327.837	43	7.624				

Note. Type III Sum of Squares

2 Assumption Checks**Test for Equality of Variances (Levene's)**

	F	df1	df2	p
PainPre_NRS	0.657	5.000	43.000	0.658
PainPost_NRS	1.034	5.000	43.000	0.410

3 Post Hoc Tests**Post Hoc Comparisons - Time * Condition**

		Mean Difference	SE	t	p _{bonf}
Post,0	Post,1	2.397	0.598	4.012	0.001
	Pre,0	0.067	0.236	0.283	1.000
	Pre,1	1.439	0.598	2.408	0.119
Post,1	Pre,0	-2.331	0.598	-3.900	0.002
	Pre,1	-0.958	0.230	-4.172	< .001
Pre,0	Pre,1	1.372	0.598	2.296	0.155

4 Descriptives**Descriptives: 1 SMP, 2 PP, 3 NP**

Time	Condition	Clinical_Cluster	Mean	SD	N
Pre	0	1	5.800	2.387	5
		2	7.000	1.563	10
		3	3.900	1.663	10
	1	1	3.250	2.053	8
		2	5.333	2.121	9
		3	4.000	1.826	7
Post	0	1	6.000	3.082	5
		2	6.700	1.636	10
		3	4.200	1.989	10
	1	1	2.375	2.669	8
		2	4.333	2.121	9
		3	3.000	1.633	7

Repeated Measures ANOVA / Covariate BDI**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	1.550	1	1.550	2.552	0.117	1.466	0.003	0.053	0.004	0.002
Time * Condition	5.309	1	5.309	8.740	0.005	14.120	0.010	0.160	0.012	0.011
Time * BDI	0.016	1	0.016	0.026	0.872	1.000	0.000	0.001	0.000	0.000
Residual	27.943	46	0.607							

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
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Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Repeated Measures ANOVA / Covariate STAI_S**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	2.224	1	2.224	3.684	0.061	2.150	0.005	0.076	0.005	0.004
Time * Condition	4.153	1	4.153	6.880	0.012	6.997	0.008	0.133	0.010	0.009
Time * STAI_S	0.798	1	0.798	1.323	0.256	1.054	0.002	0.029	0.002	0.000
Residual	27.160	45	0.604							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Repeated Measures ANOVA / Covariate IAcc**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	2.446	1	2.446	4.024	0.051	2.432	0.004	0.080	0.005	0.004
Time * Condition	6.100	1	6.100	10.037	0.003	22.856	0.011	0.179	0.013	0.011
Time * IAcc	0.002	1	0.002	0.003	0.958	1.000	0.000	0.000	0.000	0.000
Residual	27.957	46	0.608							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Repeated Measures ANOVA / Covariate IAconf**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	1.604	1	1.604	2.648	0.110	1.511	0.003	0.054	0.004	0.002
Time * Condition	6.204	1	6.204	10.246	0.002	24.686	0.011	0.182	0.014	0.012
Time * IAconf	0.104	1	0.104	0.171	0.681	1.000	0.000	0.004	0.000	0.000
Residual	27.856	46	0.606							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Repeated Measures ANOVA / Covariate BMI**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	1.008	1	1.008	1.682	0.201	1.140	0.002	0.035	0.002	0.001
Time * Condition	5.906	1	5.906	9.849	0.003	21.319	0.011	0.176	0.012	0.011
Time * BMI	0.376	1	0.376	0.627	0.433	1.000	0.001	0.013	0.001	0.000
Residual	27.583	46	0.600							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Repeated Measures ANOVA / Covariate Age**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	2.085	1	2.085	3.539	0.066	2.045	0.004	0.071	0.004	0.003
Time * Condition	5.897	1	5.897	10.008	0.003	22.614	0.011	0.179	0.012	0.011
Time * Age	0.856	1	0.856	1.453	0.234	1.082	0.002	0.031	0.002	0.001
Residual	27.103	46	0.589							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).

Repeated Measures ANOVA / Covariate Pain Yrs**Within Subjects Effects**

	Sum of Squares	df	Mean Square	F	p	VS-MPR*	η^2	η^2_p	η^2_G	ω^2
Time	0.356	1	0.356	0.602	0.442	1.000	0.001	0.013	0.001	0.000
Time * Condition	4.700	1	4.700	7.941	0.007	10.473	0.008	0.147	0.011	0.009
Time * Pain_Yrs	0.734	1	0.734	1.240	0.271	1.040	0.001	0.026	0.002	0.000
Residual	27.225	46	0.592							

Note. Type III Sum of Squares

* Vovk-Sellke Maximum p -Ratio: Based the p -value, the maximum possible odds in favor of H_1 over H_0 equals $1/(-e p \log(p))$ for $p \leq .37$ (Sellke, Bayarri, & Berger, 2001).