

## SUPPLEMENTARY MATERIAL

Gerlicher AMV, Verweij SA, Kindt M. Better, worse, or different than expected - On the role of value and identity prediction errors in fear memory reactivation.

**Supplementary Table 1.** Table illustrating which type of prediction error (i.e., model-free, model-based) was elicited by experimental manipulations during memory reactivation in the cited reconsolidation studies. The color code indicates whether these prediction-error conditions allowed for the destabilization and successful reconsolidation disruption of fear memories (green) or not (red). This perspective seems to suggest that a co-occurrence of both model-free and model-based prediction error may be a prerequisite to destabilize fear memories. However, before drawing any firm conclusions, the missing condition (model-based but no model-free prediction error) requires empirical testing.

		<b>Model-free prediction error?</b>	
		Yes	No
<b>Model-based prediction error?</b>	Yes	Unexpected omission of US <sup>1</sup> US at unexpected time <sup>2</sup>	?
	No	Unexpected omission of US in absence of US electrode <sup>3</sup>	No PE <sup>1</sup>

### Results of Day 3 FPS Analysis after Exclusion of Data of N=2 Participants

Excluding data of two participants who did not contribute day 1 and day 2 FPS data due to a technical failure with the recording software, does not affect the results on day 3. On the first retention trial on day 3, FPS were still significantly greater to the CS+ than to the CS- (stimulus:  $F_{1,55}=20.21$ ,  $p<.001$ ,  $\eta^2_p=.27$ ) in all groups (group:  $F_{2,55}=1.20$ ,  $p=.31$ ; stimulus x group:  $F_{2,55}=.81$ ,  $p=.45$ ). Differential startle responses decreased significantly from the first to the last trial of extinction (stimulus:  $F_{1,55}=26.54$ ,  $p<.001$ ,  $\eta^2_p=.33$ ; trial:  $F_{1,55}=154.60$ ,  $p<.001$ ,  $\eta^2_p=.74$ ; stimulus x trial:  $F_{1,55}=5.78$ ,  $p=.02$ ,  $\eta^2_p=.10$ ) and there were no group differences in respect to extinction (group:  $F_{2,55}=1.19$ ,  $p=.31$ ; stimulus x group:  $F_{2,55}=.25$ ,  $p=.78$ ; trial x group:  $F_{2,55}=73$ ,  $p=.48$ ; stimulus x trial x group:  $F_{2,55}=.97$ ,  $p=.39$ ). The unannounced delivery of the US1 induced a significant increase of FPS to both CS+ and CS- (i.e., non-differential reinstatement; stimulus:  $F_{1,55}=7.18$ ,  $p=.01$ ,  $\eta^2_p=.12$ ; trial:  $F_{1,55}=42.91$ ,  $p<.001$ ,  $\eta^2_p=.44$ ; stimulus x trial:  $F_{1,55}=.20$ ,  $p=.66$ ) that differed significantly between groups (group:  $F_{2,55}=2.93$ ,  $p=.06$ ,  $\eta^2_p=.10$ ; trial x group:  $F_{2,55}=3.40$ ,  $p=.04$ ,  $\eta^2_p=.11$ ; stimulus x group:  $F_{2,55}=.54$ ,  $p=.59$ ; stimulus x trial x group:  $F_{2,55}=.22$ ,  $p=.81$ ). There was no group difference at the end of extinction (stimulus:  $F_{1,55}=3.66$ ,  $p=.06$ ; group:  $F_{2,55}=.18$ ,  $p=.84$ ; stimulus x group:  $F_{2,55}=.36$ ,  $p=.70$ ), but groups differed after reinstatement (stimulus:  $F_{1,55}=4.73$ ,  $p=.03$ ,  $\eta^2_p=.08$ ; group:  $F_{2,55}=4.82$ ,  $p=.01$ ,  $\eta^2_p=.15$ ; stimulus x group:  $F_{2,55}=.44$ ,  $p=.65$ ). This effect was still driven by smaller CS- responses in the control compared to the two other groups (control vs. value-PE:  $t_{37}=-2.30$ ,  $p=.03$ ,  $d=.73$ ; control vs. identity-PE:  $t_{36}=-2.16$ ,  $p=.04$ ,  $d=.70$ ). Responses to the CS+ did not differ between control and the other groups (all  $t$ 's  $< 2.03$ ,  $p$ 's  $> .05$ ), and the value-PE and identity-PE group did not differ significantly from each other irrespective of CS+ or CS- responses (all  $t$ 's  $< .75$ ,  $p$ 's  $> .46$ ).

**Supplementary Table 2.** Mean (standard deviation) heart rate (HR) and blood pressure (BP, systolic/diastolic) assessed before the start of the experiment on day 1, and before and after the experiment on day 2 in the three experimental groups. F- and p-values refer to results of group comparisons by rmANOVA.

	no PE	MFMB PE	MB PE	F-value	p-value
Day 1 HR pre	82.1 (12.4)	78.9 (12.3)	82.7 (14.4)	.49	.61
Day 1 BP pre	119.0/79.2 (18.0/10.3)	118.9/74.8 (13.4/9.9)	116.3/77.0 (10.4/12.2)	.22/1.80	.80/.45
Day 2 HR pre	84.0 (14.4)	82.7 (18.5)	83.7 (12.9)	.04	.97
Day 2 BP pre	118.2/76.8 (14.0/7.9)	119.2/71.3 (12.4/17.7)	119.8/73.2 (10.8/8.6)	.08/1.0	.92/.35
Day 2 HR post	62.6 (8.9)	62.9 (10.5)	63.9 (10.7)	.09	.92
Day 2 BP post	103.3/70.8 (10.2/7.1)	109.8/67.3 (23.4/9.7)	103.2/70.8 (24.6/9.3)	.68/1.1	.51/.35

**Supplementary Table 3.** Average decrease of systolic/diastolic blood pressure (BP) and heart rate in propranolol HCl treated participants (values were averaged over propranolol conditions in each study).

Author/Year	$\Delta$ systolic BP	$\Delta$ diastolic
Kindt et al. (2009) <sup>4</sup>	14.45	6.8
Kindt & Soeter (2018) <sup>5</sup>	N/A	N/A
Sevenster et al. (2012) <sup>3</sup>	12.99	4.69
Sevenster et al. (2013) <sup>1</sup>	13.26	4.37
Sevenster et al. (2014) <sup>6</sup>	12.09	2.67
Soeter & Kindt (2010) <sup>7</sup>	16.28	4.83
Soeter & Kindt (2011) <sup>8</sup>	19.64	5.6
Soeter & Kindt (2012) <sup>9</sup>	22.5	6.1
Soeter & Kindt (2015) <sup>10</sup>	15.1	5.8
Soeter & Kindt (2015) <sup>11</sup>	N/A	N/A

**Supplementary Table 4.** Complete results for repeated measures ANOVAs on pre-/post-session US expectancy ratings on day 1, day 2 and day 3 with the indicated within- and between-subject factors.

	group	stimulus	US	time	group x stimul us	group x US	group x time	group x stimul us x US	stimul us x time	US x time	group x stimul us x US	group x time	stimul us x time	group x US x time	group x stimul us x US x time
Day 1	$F_{2,56}=3.0$ $p=.75$	$F_{1,56}=168.8$ $2 p<.001$	$F_{1,56}=51.63$ $p<.001$	$F_{1,56}=8.9$ $5 p=.004$	$F_{2,56}=91$ $p=.41$	$F_{2,56}=16$ $p=.85$	$F_{2,56}=14$ $p=.87$	$F_{2,56}=42$ $p=.66$	$F_{1,56}=16$ $6.82$ $p<.001$	$F_{1,56}=35.4$ $40$ $p<.001$	$F_{2,56}=61$ $p=.55$	$F_{2,56}=69.9$ $91.0$ $p<.001$	$F_{2,56}=0.00$ $p=.99$	$F_{2,56}=42$ $p=.66$	
Day 2 pre	$F_{2,57}=2.48$ $p=.09$	$F_{1,57}=197.2$ $6 p<.001$	$F_{1,57}=27.13$ $p<.001$	-	$F_{2,57}=1.1$ $2 p=.33$	$F_{2,57}=1.42$ $p=.25$	-	$F_{2,57}=16$ $p=.86$	-	-	-	-	-	-	
Day 2	$F_{2,57}=3.00$ $p=.06$	$F_{1,57}=185.8$ $8 p<.001$	$F_{1,57}=31.18$ $p<.001$	$F_{1,57}=1.6$ $1 p=.21$	$F_{2,57}=6.2$ $8 p=.003$	$F_{2,57}=5.05$ $p=.01$	$F_{2,57}=36$ $70$ $p=.70$	$F_{2,57}=7.6$ $9$ $p=.001$	$F_{1,57}=1.2$ $5 p=.29$	$F_{1,57}=4.6$ $4 p=.04$	$F_{2,57}=10.18$ $p<.001$	$F_{1,57}=13.85$ $p<.001$	$F_{2,57}=2.3$ $0 p=.11$	$F_{2,57}=13.85$ $p<.001$	

**Supplementary Table 5.** Results of post-experiment questions about the aversiveness of the two electric stimuli.

	no PE	MFMB PE	MB PE
Do you still remember the two stimuli as equally uncomfortable? - Yes/ <b>No</b>	10/ <b>10</b>	8/ <b>12</b>	12/ <b>8</b>
If not, which of the two stimuli do you remember as more uncomfortable?	N=6 US1 N=4 US2 N=10 arm	N=6 US N=6 US2 N=9 arm N=3 leg	N=4 US1 N=4 US2 N=4 arm N=4 leg

**Supplementary Table 6.** Results of repeated measures ANOVA with the indicated within- and between-subject factors on fear potentiated startle responses of a sub-sample of N=30 participants that indeed remembered the US1 and US2 still as equally aversive after the end of the experiment on day 3 (see Supplementary Table 4).

	group	stimulus	time	group x stimulus	group x time	stimulus x time	group x stimulus x time
Day 1 - conditioning	$F_{2,26}=1.71$ $p=.20$	$F_{1,26}=7.78$ , $p=.01$	$F_{1,26}=8.03$ , $p=.009$	$F_{2,26}=.58$ $p=.57$	$F_{2,26}=1.55$ $p=.23$	$F_{1,26}=8.15$ , $p=.008$	$F_{2,26}=.12$ $p=.88$
Day 2 - retrieval	$F_{2,26}=.50$ $p=.61$	$F_{1,26}=39.87$ , $p<.001$	-	$F_{2,26}=.11$ $p=.90$	-	-	-
Day 3 – retention	$F_{2,27}=2.89$ $p=.07$	$F_{1,27}=9.27$ , $p=.005$	-	$F_{2,27}=.26$ $p=.77$	-	-	-
Day 3 – extinction	$F_{2,27}=4.63$ $p=.02$	$F_{1,27}=12.59$ , $p=.001$	$F_{1,27}=81.03$ , $p<.001$	$F_{2,27}=.09$ $p=.91$	$F_{2,27}=1.13$ $p=.34$	$F_{1,27}=3.47$ , $p=.07$	$F_{2,27}=.43$ $p=.65$
Day 3 – reinstatement	$F_{2,27}=2.33$ $p=.12$	$F_{1,27}=12.63$ , $p=.001$	-	$F_{2,27}=.66$ $p=.53$	-	-	-