

**Investigating the effects of imagery rescripting on emotional memory:  
A series of analogue studies**

Anna E. Kunze<sup>\*</sup>, Arnoud Arntz, & Merel Kindt

**SUPPLEMENTARY MATERIAL**

\*Correspondence concerning this article should be addressed to Anna E. Kunze, LMU  
Munich, Department of Clinical Psychology and Psychotherapy, Leopoldstraße 13, 80802  
Munich, Germany, [anna.kunze@psy.lmu.de](mailto:anna.kunze@psy.lmu.de)

## Measures

### Conditioned Responding

**Fear-potentiated startle.** Conditioned fear responses were measured by means of electromyography (EMG) of the left orbicularis oculi muscle. The eye blink reflex was elicited by a 104 dB, 40 msec burst of broadband white noise with near instantaneous rise time (e.g., Kindt, Soeter, & Vervliet, 2009; Kunze, Arntz, & Kindt, 2015; Sevenster, Beckers, & Kindt, 2013), delivered binaurally through headphones (Sennheiser, model HD 25-1 II). Startle EMG activity was measured with three 6 mm sintered Ag/AgCl electrodes (BioMed BME-175) filled with electrolyte gel (Signa Gel, Parker), two of which were positioned approximately 1 cm below the pupil and 1 cm below the lateral canthus (outer corner of the eye; Fridlund & Cacioppo, 1986). A ground electrode was placed on the participants' forehead (Blumenthal et al., 2005). The electrodes were connected to a custom made bipolar EMG amplifier with an input resistance of 1GOhm and a bandwidth of 5-1000 Hz (6 dB/oct). To remove unwanted mains noise, a 50Hz notch filter was used. The notch filtered EMG signal was sampled at 1000 S/s (National Instruments, NI-USB6210). In line with previous studies from our lab (e.g., Kunze et al., 2015; Sevenster et al., 2013), raw EMG data were subsequently band-pass filtered (28-500 Hz, Butterworth 4<sup>th</sup> order; Blumenthal et al., 2005), and peak amplitudes of the eye blink reflex were identified within a 0-175 msec latency window following probe onset (VSRRP98, University of Amsterdam).

**Subjective distress.** Subjective distress towards the CSs was measured on a continuous colored rating scale ranging from 0 (green; *not at all distressed*) to 100 (red; *very distressed*). The vertical scale was presented 2.5 sec after stimulus onset to the right of the stimulus picture (Kunze et al., 2015; Soeter & Kindt, 2012). Participants rated their distress during each CS presentation on the computer screen by shifting the mouse cursor with their preferred hand and pushing the left mouse button within 5 sec (i.e., before presentation of the startle probe). On the rare occasion that participants did not indicate their level of distress within 5 sec, the value corresponding to the last position of the mouse cursor at 7.5 sec was recorded. The cursor automatically returned to the middle of the scale when participants were presented with a new stimulus.

**Skin conductance responses.** Electrodermal activity (SCL, skin conductance level) was measured with a sine wave shaped excitation voltage (1V pk-pk, 50Hz). The SCL circuit measures the current flowing through the skin from the output electrode to a GND electrode and converts this current to a conductance value. The converted value was sampled at 1000

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S/s. Two curved Ag/AgCl electrodes (20 mm x 16 mm) were attached to the medial phalanges of the first and third finger of the non-preferred hand with adhesive tape. Skin conductance responses (SCR) were calculated by subtracting the baseline (1 sec before stimulus onset) from the maximum score during the 0 to 7.5 s window after CS onset (e.g., Kunze et al., 2015; Milad, Orr, Pitman, & Rauch, 2005; Orr et al., 2000; Pineles, Orr, & Orr, 2009).

**Heart rate.** Heart rate (HR) was measured using three electrode patches (3M, Red Dot, Micropore Tape and Solid Gel), one of which was placed on the sternum near the second inter-costal space. The other two electrodes were placed left and right over the sixth rib on the anterior axillary line. ECG was measured with an amplifier similar to the EMG input, but with a bandwidth of 0.1 Hz (6 dB/oct) to 250 Hz (24 dB/oct) and was sampled at 1000 S/s. The recorded R waves were transformed into an interpolated inter-beat-interval trace from which the average heart rate per half second was calculated.

Per half-second bin, heart rates were averaged for CS+ and CS- each. Average heart rate 1 second before stimulus onset was subtracted from the average heart rate per half second after stimulus onset (7.5 sec). Initial (D1) and secondary deceleration (D2) and midinterval acceleration (A) were scored according to Hodes, Cook, and Lang (1985), with D1 being the minimum heart rate during the first 2 sec following CS onset, A being the maximum heart rate subsequent to D1 and within the first 5 sec after CS onset, and D2 being the minimum heart rate subsequent to A, but before UCS onset (Sevenster, Hamm, Beckers, & Kindt, 2015; Van Diest, Bradley, Guerra, Van den Bergh, & Lang, 2009).

### Questionnaires

**State-Trait Anxiety Inventory.** The State-Trait Anxiety Inventory (STAI-T/STAI-S; Spielberger, Gorsuch, & Lushene, 1970) was used to assess state and trait anxiety levels. The questionnaire consists of 20 items assessing trait anxiety and 20 items assessing state anxiety. Ratings were made on a 4-point scale, ranging from 1 (*Not at all*) to 4 (*Very much*), with higher scores reflecting greater anxiety. The STAI disposes over high construct and concurrent validity (Spielberger, 1989) and Cronbach's alpha has been found to range from .86 to .95 (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).

**Positive and Negative Affect Schedule.** The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to assess mood changes resulting from the aversive film and the imagery intervention. Two dimensions (i.e., positive affect and negative affect) were each measured by 10 items, ranging from 1 (*Not at all*) to 5 (*Very*

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*much*). The instrument has been found to have high internal consistency, with Cronbach's alpha ranging from .86 to .90 for the positive affect scale, and .84 to .87 for the negative affect scale (Watson et al., 1988).

**Impact of Event Scale.** An adapted version of the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979) was used to assess analogue posttraumatic symptoms with regard to the aversive film clip. In light of the nature of the aversive event (i.e., a film clip), item 8 of the original questionnaire ('I felt as if it hadn't happened or it wasn't real.') was discarded. Two dimensions (i.e., avoidance and intrusions) were measured by 7 items each. Ratings were made on a 4-point scale ranging from 0 (*Never*) to 5 (*Often*). The subscales of the instrument were found to dispose over high internal consistency, with Cronbach's alpha ranging from .78 (intrusion) to .82 (avoidance).

**Self-Assessment Manikins.** Self-Assessment Manikins (SAM; Bradley & Lang, 1994) were used to assess valence and arousal towards the CSs. The two dimensions were each measured with two items, and the average score of both items served as outcome for each dimension (i.e., valence and arousal). The SAM scales are non-verbal pictorial ratings scales, which have been shown to reliably and validly assess valence and arousal to a wide range of stimuli (the dominance scale was discarded in the present study). The instrument disposes over high construct validity, and Cronbach's alpha range from .63 to .82 for the valence scale, and .93 to .98 the arousal scale (Bucks, da Silva, & Han, 2005).

**Manipulation check.** In order to evaluate participants' responses to the aversive film, fear conditioning, and intervention phases of the experiment, a number of items measuring stimulus intensity (i.e., startle probe and UCS aversiveness), and several characteristics of the imagery exercise (e.g., (un)pleasantness, vividness, valence, intensity) were assessed. Ratings were made on 11-point Likert-scales ranging from -5 (*Not at all*) to 5 (*Very much*).

**Post-experimental questionnaires.** At the conclusion of each experiment, participants were presented with several (open) questions, which assessed their reaction toward the aversive film, intervention, and the experiment.

## Materials

### Film stimulus

The aversive film used in the present study consisted of a 12 min compilation of different scenes from "Salò, or the 12 Days of Sodom" (Pasolini, 1975). The assembled

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scenes include physical violence, abuse, torture, and physical sexual harassment (see also Kunze et al., 2015).

### **Conditioning stimuli**

The unconditioned stimulus (UCS) consisted of a 3 sec film fragment originating from the aversive film, where a girl screams loudly after she was forced to eat a piece of cake with nails in it. The visual and auditory representation of this human scream was used as UCS (peak at 85 dB). Two different pictures were used as conditioned stimuli (CS). The CSs were presented on a black background in the middle of the computer screen. The reinforced CS (CS+), a picture of one of the offenders from the aversive film who forces a girl to eat a piece of cake with nails in it, was paired with the UCS with a 100% contingency during fear acquisition. A picture of a different man who is unrelated to the aversive film served as unreinforced CS (CS-) and was never paired with the UCS.

### **Imagery exercises**

**Experiment 1.** The imagery interventions consisted of either imagery rescripting (IR) or imaginal exposure (IE) to the content of the aversive film. Both interventions included a reactivation phase (approx. 1 min) and an intervention phase (approx. 5 min). During the reactivation phase, the experimenter read an excerpt from the aversive film out loud, while participants were instructed to close their eyes and vividly imagine everything the experimenter read to them. The content of the memory reactivation included the scenes leading to the hotspot (UCS), where the perpetrator (CS+) holds a piece of cake with nails in his hands and commands a girl to come over to him. In order to integrate the reactivation of the aversive film with an explicit reactivation of the conditioned stimulus (CS+), participants opened their eyes after the imaginal reactivation and looked at the computer screen, where a picture of the CS+ was presented.

During the intervention phase, participants were presented with different sets of instructions after reactivation. In the IR condition, participants were instructed to rescript the reactivated event from the film clip into a less aversive storyline. For this purpose, participants were asked to think about a more satisfying outcome of the scene and to imagine this new script as vividly as possible. Participants were allowed to construct any script they liked, whether it was realistic (e.g., the kidnapped kids overcome the perpetrators and are rescued) or unrealistic (e.g., a superhero rescues the girl from the perpetrator and brings her to a safe place). They were specifically instructed to devise a script that would result in a less distressing and more satisfying outcome, and to go on with the rescripting until they were

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entirely satisfied with the new scene. Participants in the IE condition were instructed to recall and re-experience the most aversive scene (UCS) from the film clip. Exercise instructions were adapted from Hagedaars & Arntz (2012). Including instructions, imagery interventions lasted on average 9:36 min and 10:03 min in the IE and IR condition, respectively.

After reactivation and after the intervention, participants rated their subjective levels of distress (SUD) and the vividness of the scene on front of their inner eye on a scale from 0-10, while keeping their eyes closed.

**Experiment 2.** The imagery exercises (i.e., devaluation or inflation) used in Experiment 2 consisted of 5 min audio scripts. In line with Experiment 1, both imagery exercises contained a reactivation (approx. 1 min) and an intervention phase (approx. 4 min). Before the exercise, participants were told that they would hear a story about the movie they previously watched. They were further instructed to close their eyes during the imagery exercise and to imagine everything they hear as vividly as possible from the first-person perspective. Since it was shown that including the most aversive scenes of aversive memories to the reactivation increases the effectiveness of IR (Dibbets & Arntz, 2016), the reactivation included the hotspot of the aversive film, up to and including the moment where the girl screams when she bites on a piece of cake with nails in it (UCS).

The intervention commenced immediately after reactivation. In the devaluation condition, the aversive film was degraded by means of a story about the actors. Specifically, the script started by imagining the director of the scene shouting “cut” and congratulating the girl on her acting capabilities. The script further included the perpetrator, depicted as an actor who finds it difficult to play such brutal scenes and who is concerned about the actors playing the victims. In the inflation condition, the aversiveness of the aversive film was further increased by means of a story about how the girl is further tortured and humiliated by the perpetrators until she finally passed out.

**Experiment 3.** In line with Experiment 2, both imagery scripts (i.e., IR and IE) consisted of a short reactivation (1 min) and an intervention (4 min) phase. Based on feedback from participants in Experiment 2, the IR intervention was further improved. Specifically, while the script was read by a male in Experiment 2, a number of participants indicated that they would have preferred a female voice. In addition, specific feedback from participants about the content of the scene was integrated into the new script (e.g., elaborate on some of the positive scenes, make the script more realistic, etc.). The IE script consisted of a detailed repetition of the most aversive scenes from the film.

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Instructions about the exercise were similar to those used in Experiment 2. Given that the experimenter was blind for the intervention condition of the participant, instructions before the imagery exercise were the same in both intervention groups. However, it should be noted that when participants do the rescripting themselves, they are specifically instructed to change the aversive scene into something more positive before the exercise. Thus, participants are aware of the fact that the aversive story will be changed into something more positive. Since it is unknown whether this might be part of (or add to) the therapeutic effect of IR, in the present study, we tried to mimic this effect by having both scripts delivered twice: Before the first imagery exercise, participants were simply instructed that they would hear a story about the movie they previously watched. After the first intervention, participants were told that they would be presented with the same story again. Thus, before the second imagery intervention, participants in the rescripting condition knew that the audio script would be positive, while participants in the exposure condition knew that they would receive the rehearsal of the aversive film again. In line with Experiment 1, the interventions lasted approx. 10 min in total.

### **Fear conditioning**

All three experiments consisted of instructed differential fear conditioning procedures. Order of trial type was randomized within blocks of 3 trials (i.e., CS+, CS-, and noise alone (NA) startle probes), and inter-trial intervals varied between 15, 20 and 25 sec with a mean of 20 sec. During each trial, the startle probe was presented 7.5 sec after stimulus onset, followed by the UCS after 500 msec for approximately 3 sec (see also Kunze et al., 2015).

*Fear acquisition.* Upon arrival in the laboratory, participants studied the information brochure. Questions about the study were answered by the experimenter and participants were interviewed regarding any medical, physical, and psychological conditions that would contraindicate participation. If no exclusion criteria were met, written informed consent was obtained. After attachment of EMG and SCR electrodes and a signal check, participants were instructed to rate their distress levels during each CS presentation. Then, participants were presented with ten NA startle probes, to allow startle responses to habituate before testing. To assess baseline differences in responding toward the CS+ and CS-, both stimuli were presented once after the startle habituation phase (both unreinforced; baseline). Subsequently, participants were told that they would watch a 12 min aversive film, and they were explicitly instructed about the fear acquisition procedure, which followed after the aversive film. Participants were given the following instructions: “After the movie, you will see two

different pictures appear on the screen. One of these photos depicts a man, who will be in the movie you are about to watch. The other photo shows a man, who will not be in the movie, and who is completely unrelated to the movie. The photo of the man from the movie will always be followed by another short film clip, which also stems from the movie you are about to watch. The other picture (the picture of the man who is not in the movie) will never be followed by the film clip. The fact that the picture of the man, who is not in the movie, will never be followed by a short film clip holds for the entire experiment.” Participants were then asked to repeat the instructions in their own words and were corrected if necessary. During the aversive film, 24 startle probes were presented with mean ITIs of 30 sec, to further ensure habituation to the startle probe. Fear *acquisition* started immediately after the presentation of the aversive film (with only two NA startle probes between the two experimental phases). During acquisition, CS+, CS-, and NA were each presented three times.

*Intervention and Test phase.* The interventions differed across the three experiments (see section ‘imagery exercises’). Also, the testing phases after the intervention were adapted according to the hypotheses of the three experiments. For specific information about the test phases, we refer the reader to the main manuscript.

### **Data reduction**

Missing questionnaire items on STAI, PANAS, and IES were replaced by each individual’s average score on a particular (sub-)scale. Participant who were missing entire questionnaires were excluded from the analysis of those specific variables.

Fear-potentiated startle responses and SCR scores that surpassed three standard deviations above or below individual peak average amplitude were regarded as outliers (e.g., Sevenster et al., 2015). Such values were replaced by the mean-plus/minus-three standard deviations, calculated over all testing trials (but not habituation trials) per individual, excluding the previously defined outlier trial(s). The FPS data were subsequently Z-transformed to reduce between-subject variability (Kunze et al., 2015; Visser, Kunze, Westhoff, Scholte, & Kindt, 2015). Raw absolute SCR scores were square-root transformed. For negative raw values, the negative sign was re-applied after transformation (Krypotos, Arnaudova, Effting, Kindt, & Beckers, 2015; Milad et al., 2006).

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To control for baseline differences in CS+ and CS- distress ratings, in all three experiments, CS baseline scores were subtracted from all subsequent CS+ and CS- scores, respectively.

### Data analyses

Criterion for significance was set a  $p < .05$  for all analyses, and partial eta squared ( $\eta_p^2$ ; Cohen, 1988) was used as effect size in ANOVAs. If possible, FPS, SCL, and online distress data were averaged over blocks of two trials for each stimulus type to reduce between-subject variability (Kunze et al., 2015; Sevenster et al., 2013).

### Experiment 1

In line with our previous experiment (Kunze et al., 2015), main analyses of FPS, SCR, and online distress data consisted of a series of mixed repeated-measures ANOVAs with between-subjects factor Condition (IR vs. IE), and within-subjects factors Stimulus (CS+ vs. CS-) and Trial (blocks of stimulus presentations). NA startle trials were analyzed with separate mixed repeated-measures ANOVAs with between-subjects factor Condition (IR vs. IE) and within-subjects factor Trial (blocks of stimulus presentations) for the same testing phases as CS+ and CS-. For PANAS and STAI-S scores, mixed repeated-measures ANOVAs with between-subjects factor Condition (IR vs. IE) and within-subjects factor Time (before fear learning vs. after fear learning, after fear learning vs. after intervention, before extinction vs. after extinction) were conducted. Following up on significant interactions, planned comparisons were performed for each condition or time point separately. Several independent samples t-tests were conducted on STAI-T, age, UCS aversiveness, startle probe intensity, pleasantness of the imagery exercise, and IES subscales to assess possible group differences. Moreover, for subjective distress and vividness ratings over the course of the imagery exercise, repeated measures ANOVAs with between-subjects factor Condition (IR vs. IE) and within-subjects factor Time (after reactivation vs. after intervention) were conducted.

### Experiment 2

For FPS, SCR, and online distress data, main analyses consisted of a series of mixed repeated-measures ANOVAs with between-subjects factor Condition (devaluation vs. inflation vs. control), and within-subjects factors Stimulus (CS+ vs. CS-) and Trial (blocks of stimulus presentations). Following up on significant interactions, planned comparisons were performed for each condition and/or time point separately. NA startle trials were analyzed with separate mixed repeated-measures ANOVAs with between-subjects factor Condition (IR

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vs. IE) and within-subjects factor Trial (blocks of stimulus presentations). Several univariate ANOVAs were conducted on age, STAI-T, UCS aversiveness, and pleasantness and vividness of the imagery exercise. Pearson's Chi-Square was used to assess the distribution of gender across conditions. For each emotion assessed by means of VAS, a mixed repeated-measures ANOVA with between-subjects factor Condition (devaluation vs. inflation vs. control) and within-subjects factor Time (before fear learning vs. after fear learning, after fear learning vs. after intervention, before extinction vs. after extinction) were conducted. Following up on significant interactions, Bonferroni-corrected planned comparisons were performed for each time point separately. SAM ratings were analyzed with a mixed repeated-measures ANOVA with between-subjects factor Condition (devaluation vs. inflation vs. control) and within-subjects factor Time (SAM<sub>1</sub> vs. SAM<sub>2</sub>).

### **Experiment 3**

Main analyses of FPS, HR, and online distress data consisted of mixed factorial repeated-measures ANOVAs with between-subjects factor Condition (IR vs. IE vs. control), and within-subjects factors Stimulus (CS+ vs. CS-) and Trial (blocks of stimulus presentations). In case of HR, all previously identified HR components (see section 'measures') were analyzed separately (van Diest et al., 2009). Following up on significant interactions, planned comparisons were performed for each condition or time point separately. NA startle trials were analyzed with separate mixed repeated-measures ANOVAs with between-subjects factor Condition (IR vs. IE) and within-subjects factor Trial (blocks of stimulus presentations). Univariate ANOVAs were conducted on age, STAI-T, UCS aversiveness, startle probe intensity, as well as pleasantness, vividness, valence and intensity of the imagery exercise. Pearson's Chi-Square was used to assess the gender distribution across conditions. For SAM ratings, a mixed repeated-measures ANOVA with between-subjects factor Condition (IR vs. IE vs. control) and within-subjects factor Time (SAM<sub>1</sub> vs. SAM<sub>2</sub>) were conducted. In addition, several repeated measures ANOVAs with between-subjects factor Condition (IR vs. IE vs. control) and within-subjects factor Time (before fear learning vs. after fear learning, after fear learning vs. after intervention, beginning of day 2 vs. end of day 2), were conducted for STAI-S, PANAS, and VASs data. Following up on significant interactions, Bonferroni-corrected planned comparisons were performed for each time point separately.

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Table A.1

*Experiment 1: Means and standard deviations (in parenthesis) per group for demographic characteristics, STAI-T, STAI-S, PANAS, IES, UCS aversiveness, startle probe intensity, and imagery exercise ratings*

Measures	Group		Test Statistic
	Imagery Rescripting ( <i>n</i> = 30)	Imaginal Exposure ( <i>n</i> = 31)	
<b>Age</b>	20.74 (1.95)	22.10 (2.77)	$t(59) = -2.22^*$
<b>Gender</b>	10 male	11 male	$X^2(1) = 0.03$
<b>STAI-T</b>	39.03 (4.52)	38.94 (5.98)	$t < 1$
<b>UCS aversiveness</b>	3.20 (1.83)	3.10 (1.58)	$t < 1$
<b>Startle probe intensity</b>	3.00 (0.74)	3.00 (0.86)	$t < 1$
<b>STAI-S</b>			
Before fear learning (day 1)	33.37 (7.17)	31.12 (6.42)	
After fear learning (day 1)	43.97 (9.66)	41.81 (10.47)	
After intervention (day 1)	35.07 (7.33)	39.84 (11.77)	
Before extinction (day 2)	31.07 (7.05)	31.81 (6.92)	
After extinction (day 2)	39.37 (10.65)	38.68 (10.76)	
<b>Negative Affect</b>			
Before fear learning (day 1)	13.10 (4.18)	11.93 (3.49)	
After fear learning (day 1)	19.69 (6.99)	18.39 (7.95)	
After intervention (day 1)	13.98 (5.34)	15.97 (7.24)	
Before extinction (day 2)	12.28 (4.86)	11.55 (2.29)	
After extinction (day 2)	15.69 (6.32)	14.84 (5.99)	
<b>Positive Affect</b>			
Before fear learning (day 1)	29.28 (6.23)	29.29 (7.07)	
After fear learning (day 1)	23.76 (7.52)	23.77 (6.60)	
After intervention (day 1)	28.28 (6.63)	23.27 (7.39)	
Before extinction (day 2)	28.03 (5.01)	25.61 (7.08)	
After extinction (day 2)	21.78 (6.42)	22.00 (6.61)	
<b>Imagery Exercise</b>			
Distress			
After reactivation	6.00 (1.85)	5.40 (1.93)	
After intervention	3.93 (1.87)	6.40 (1.94)	
Vividness			
After reactivation	8.17 (0.79)	7.77 (0.92)	
After intervention	7.25 (1.33)	8.11 (0.95)	
Pleasantness	1.17 (2.51)	-0.68 (2.33)	$t(59) = -2.98^*$
<b>IES</b>			
Avoidance	6.50 (6.38)	6.80 (5.93)	$t < 1$
Intrusion	4.34 (4.38)	4.97 (4.57)	$t < 1$

Note.  $*p < .05$

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Table A.2

*Experiment 1: Mixed repeated-measures ANOVA results with between-subjects factor Condition (IR vs. IE) and within-subjects factors Stimulus (CS+ vs. CS-) and Trial for subjective distress*

	<i>F</i>	<i>df</i>	<i>p</i>	$\eta_p^2$
<b>(a) CS baseline</b>				
Stimulus	11.00	1, 59	.002	.16
Stimulus × Condition	0.34	1, 59	.564	<.01
Condition	0.01	1, 59	.944	<.01
<b>(b) Acquisition (Acq 1 vs Acq 3)</b>				
Stimulus	151.26	1, 59	<b>&lt;.001</b>	.72
Stimulus × Condition	1.13	1, 59	.292	.02
Trial	<0.01	1, 59	.970	<.01
Trial × Condition	5.47	1, 59	.023	.09
Stimulus × Trial	6.47	1, 59	.014	.10
Stimulus × Trial × Condition	10.40	1, 59	<b>.002</b>	.15
Imagery Rescripting	0.30	1, 29	.586	.01
Imaginal Exposure	13.64	1, 30	.001	.31
Condition	0.99	1, 59	.325	.02
<b>(c) Retention test (Acq 3 vs Ext 1/2)</b>				
Stimulus	123.98	1, 59	<b>&lt;.001</b>	.68
Stimulus × Condition	<0.01	1, 59	.947	<.01
Trial	33.63	1, 59	<.001	.36
Trial × Condition	3.23	1, 59	.078	.05
Imagery Rescripting	28.38	1, 59	<b>&lt;.001</b>	.33
Imaginal Exposure	8.14	1, 59	<b>.006</b>	.12
Stimulus × Trial	23.24	1, 59	<b>&lt;.001</b>	.28
Stimulus × Trial × Condition	0.03	1, 59	.860	<.01
Condition	0.87	1, 59	.354	.02
<b>(d) Transfer test (Ext 1/2)</b>				
Stimulus	93.60	1, 59	<b>&lt;.001</b>	.61
Stimulus × Condition	0.02	1, 59	.904	<.01
Condition	2.36	1, 59	.130	.04
<b>(e) Extinction (all trials)</b>				
Stimulus	65.36	1, 59	<.001	.53
Stimulus × Condition	0.90	1, 59	.348	.02
Trial	9.27	1.93, 113.86	<.001	.14
Trial × Condition	1.36	1.93, 113.86	.260	.02
Stimulus × Trial	22.76	3.29, 193.88	<b>&lt;.001</b>	.28
Stimulus × Trial × Condition	1.88	3.29, 193.88	.128	.03
Condition	1.32	1, 59	.255	.02
<b>(f) Extinction (Ext 19/20)</b>				
Stimulus	49.35	1, 59	<b>&lt;.001</b>	.46
Stimulus × Condition	1.51	1, 59	.225	.03
Condition	0.38	1, 59	.539	.01
<b>(g) Reinstatement (Ext 19/20 vs Test 1/2)</b>				
Stimulus	91.03	1, 59	<.001	.61
Stimulus × Condition	0.23	1, 59	.632	<.01
Trial	74.15	1, 59	<.001	.56
Trial × Condition	0.32	1, 59	.573	.01
Stimulus × Trial	57.89	1, 59	<b>&lt;.001</b>	.50
Stimulus × Trial × Condition	3.26	1, 59	.076	.05
Condition	0.77	1, 59	.383	.01

*Note.* Significant *p*-values relevant for the interpretation of the results are marked bold.

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Table A.2 (continued)

	<i>F</i>	<i>df</i>	<i>p</i>	$\eta_p^2$
<b>(h) Reinstatement (all trials)</b>				
Stimulus	98.35	1, 59	<.001	.63
Stimulus $\times$ Condition	<0.01	1, 59	1.00	<.01
Trial	25.19	1.78, 105.04	<.001	.30
Trial $\times$ Condition	0.39	1.78, 105.04	.655	.01
Stimulus $\times$ Trial	9.75	1.61, 95.04	<b>&lt;.001</b>	.14
Stimulus $\times$ Trial $\times$ Condition	0.46	1.61, 95.04	.591	.01
Condition	0.95	1, 59	.334	.02

*Note.* Significant *p*-values relevant for the interpretation of the results are marked bold.

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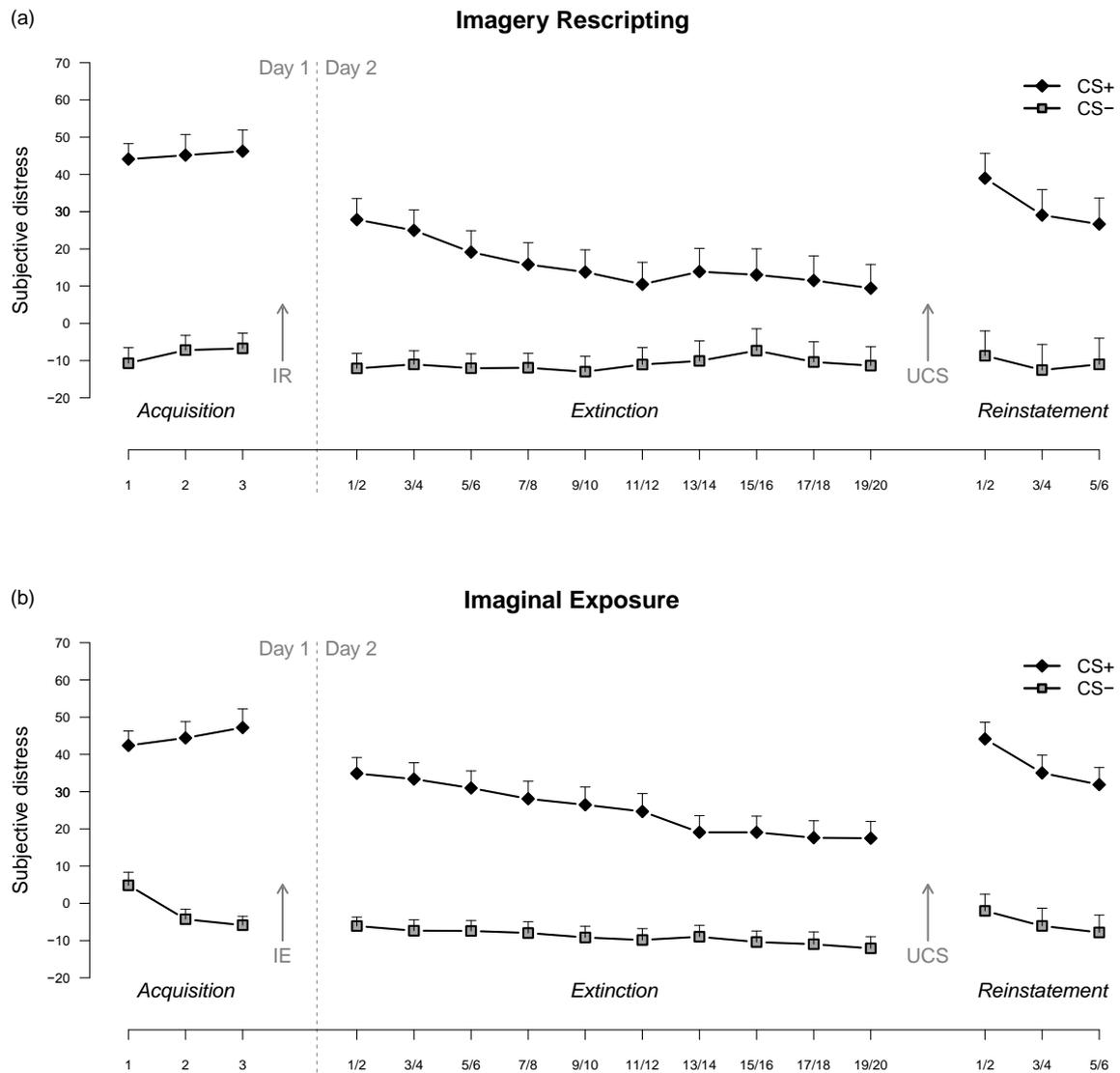


Figure A. Experiment 1: Mean subjective distress responses to CS+ and CS- during fear acquisition, extinction, and reinstatement test for the (a) imagery rescripting (IR) and (b) imaginal exposure (IE) condition. Error bars represent SEM.

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Table B.1

Experiment 2: Mean and standard deviations (in parenthesis) per group for age, gender, STAI-T, UCS aversiveness, SAM, emotions, and imagery exercise ratings

Measures	Group			Test Statistic
	Devaluation (n = 22)	Inflation (n = 22)	Control (n = 22)	
<b>Age</b>	22.04 (3.42)	22.32 (3.99)	21.91 (2.62)	$F(2,63) = 0.08$
<b>Gender</b>	7 male	8 male	3 male	$\chi^2(2) = 3.21$
<b>STAI-T</b>	40.00 (5.01)	37.73 (4.97)	37.82 (5.38)	$F(2,63) = 1.39$
<b>UCS aversiveness</b>	-3.50 (1.37)	-4.18 (1.18)	-3.14 (1.96)	$F(2,63) = 2.61$
<b>Shame</b>				
Before fear learning	9.86 (11.74)	21.68 (27.10)	9.55 (18.52)	
After fear learning	22.55 (23.41)	26.09 (24.68)	13.09 (15.76)	
After intervention	8.41 (8.61)	25.09 (23.69)	6.45 (10.11)	
Before extinction	3.00 (3.99)	5.95 (6.83)	3.09 (6.72)	
After extinction	4.86 (11.34)	10.59 (12.99)	3.77 (7.62)	
<b>Fear</b>				
Before fear learning	14.14 (19.10)	14.59 (13.94)	5.95 (10.05)	
After fear learning	33.00 (22.71)	35.27 (25.62)	18.14 (17.00)	
After intervention	12.00 (11.63)	36.73 (28.48)	5.18 (8.06)	
Before extinction	3.36 (4.17)	7.36 (10.90)	2.36 (4.89)	
After extinction	4.73 (11.22)	12.27 (16.96)	3.09 (5.84)	
<b>Tension</b>				
Before fear learning	23.00 (19.74)	31.50 (24.97)	12.14 (14.15)	
After fear learning	44.36 (23.49)	54.32 (25.37)	30.09 (22.29)	
After intervention	20.09 (16.11)	47.32 (29.83)	8.23 (10.47)	
Before extinction	6.05 (7.68)	17.18 (20.18)	3.41 (6.53)	
After extinction	8.95 (15.97)	21.00 (21.01)	4.82 (8.56)	
<b>Anger</b>				
Before fear learning	4.82 (7.54)	4.50 (7.61)	1.86 (3.27)	
After fear learning	45.14 (30.57)	39.50 (35.44)	29.45 (25.78)	
After intervention	14.64 (18.42)	39.45 (36.34)	3.64 (5.34)	
Before extinction	2.91 (4.89)	8.00 (16.07)	1.50 (2.97)	
After extinction	4.18 (5.56)	13.91 (19.04)	2.18 (3.57)	
<b>Imagery Exercise</b>				
Pleasantness	2.36 (2.01)	-3.27 (1.83)	N/A	$F(1,42) = 94.41^{**}$
Vividness	3.18 (1.40)	3.05 (2.30)	N/A	$F(1,42) = 0.06$
<b>SAM<sub>(SAM1-SAM2)</sub></b>				
CS+ Valence	-0.68 (1.89)	-1.57 (1.80)	-2.26 (1.34)	
CS+ Arousal	1.16 (2.20)	2.32 (2.15)	2.50 (1.82)	
CS- Valence	1.45 (1.43)	1.45 (1.19)	1.44 (0.98)	
CS- Arousal	-1.70 (1.84)	-1.93 (1.96)	-1.80 (1.22)	

Note. \* $p < .05$ ; \*\* $p < .001$

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Table B.2

*Experiment 2: Mixed repeated-measures ANOVA results with between-subjects factor Condition (devaluation vs. inflation vs. control) and within-subjects factors Stimulus (CS+ vs. CS-) and Trial for fear-potentiated startle*

	<i>F</i>	<i>df</i>	<i>p</i>	$\eta_p^2$
<b>(a) CS baseline</b>				
Stimulus	1.16	1, 62	.287	.02
Stimulus × Condition	0.90	2, 62	.411	.03
Condition	2.35	2, 62	.104	.07
<b>(b) Acquisition (Acq 1 vs Acq 3)</b>				
Stimulus	9.95	1, 62	.002	.14
Stimulus × Condition	0.63	2, 62	.534	.02
Trial	0.01	1, 62	.927	<.01
Trial × Condition	1.74	2, 62	.184	.05
Stimulus × Trial	7.28	1, 62	<b>.009</b>	.11
Stimulus × Trial × Condition	1.56	2, 62	.219	.05
Condition	0.57	2, 62	.566	.02
<b>(c) Intervention test (Acq 3 vs Ext 1/2)</b>				
Stimulus	21.38	1, 62	<b>&lt;.001</b>	.26
Stimulus × Condition	0.02	2, 62	.983	<.01
Trial	1.43	1, 62	.237	.02
Trial × Condition	0.47	2, 62	.628	.02
Stimulus × Trial	4.54	1, 62	<b>.037</b>	.07
CS+	0.05	1, 62	.817	<.01
CS-	5.99	1, 62	.017	.09
Stimulus × Trial × Condition	1.08	2, 62	.345	.03
Condition	0.45	2, 62	.640	.01
<b>(d) Extinction (all trials)</b>				
Stimulus	11.72	1, 62	<.001	.16
Stimulus × Condition	1.63	2, 62	.205	.05
Trial	36.57	3, 186	<.001	.37
Trial × Condition	1.07	6, 186	.384	.03
Stimulus × Trial	4.38	3, 186	<b>.005</b>	.07
Stimulus × Trial × Condition	1.34	6, 186	.242	.04
Condition	1.07	2, 62	.348	.03

*Note.* Significant *p*-values relevant for the interpretation of the results are marked bold.

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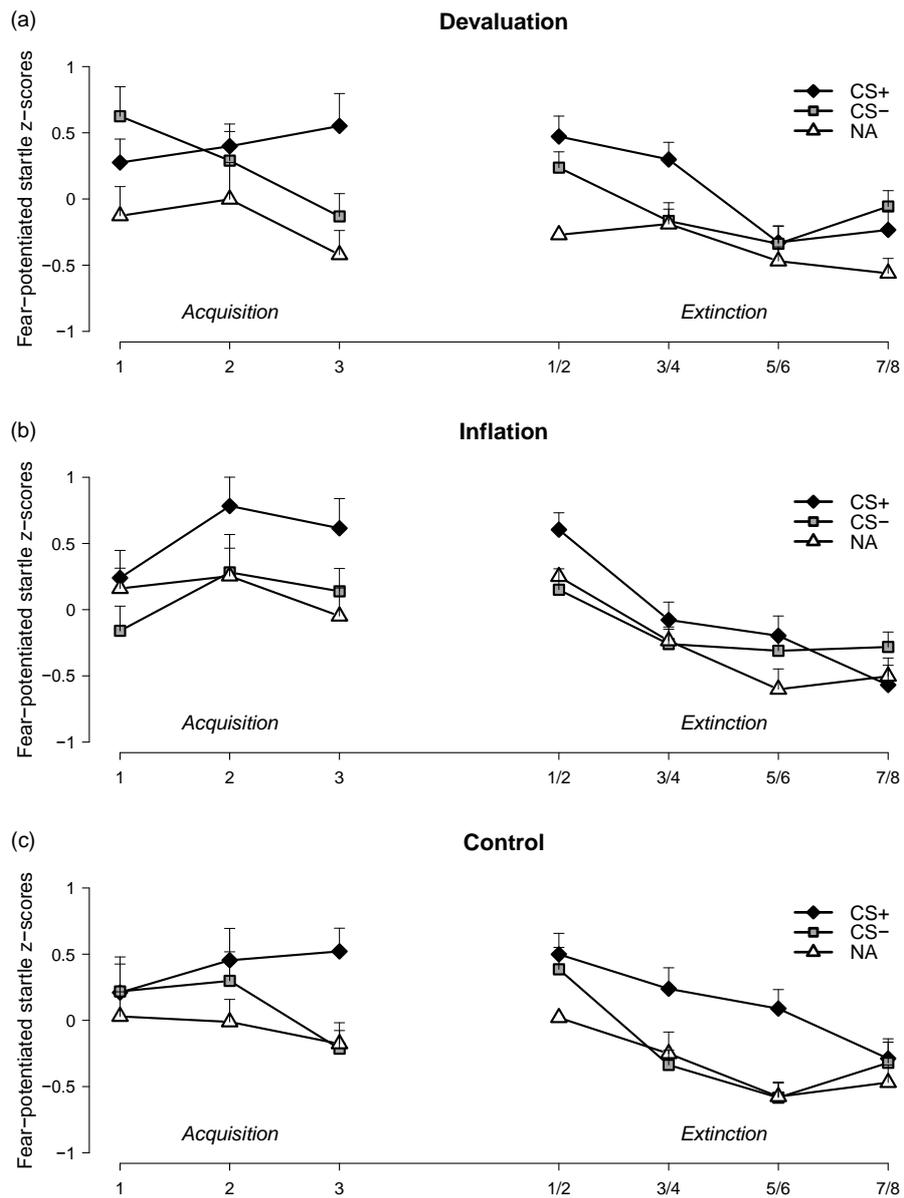


Figure B. Experiment 2: Mean fear-potentiated startle responses to CS+, CS- and NA during fear acquisition and extinction for the (a) devaluation, (b) inflation, and (c) control condition. Error bars represent SEM.

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Table C.1

Experiment 3: Means and standard deviations (in parenthesis) per group for age, gender, STAI-T, UCS aversiveness, startle probe intensity, STAI-S, PANAS, SAM, emotions, and imagery exercise ratings

Measures	Group			Test Statistic
	Rescripting (n = 26)	Exposure (n = 24)	Control (n = 24)	
<b>Age</b>	22.73 (5.65)	21.96 (2.94)	22.96 (4.77)	$F(2,70) = 0.28$
<b>Gender</b>	6 male	6 male	7 male	$\chi^2(2) = 0.25$
<b>STAI-T</b>	36.23 (5.13)	37.22 (3.42)	37.77 (5.73)	$F(2,68) = 0.63$
<b>UCS aversiveness</b>	2.50 (3.16)	2.17 (2.98)	2.04 (3.42)	$F(2,68) = 0.13$
<b>Startle probe intensity</b>	0.44 (2.65)	-0.29 (2.44)	1.58 (2.80)	$F(2,70) = 3.10$
<b>STAI-S</b>				
Before fear learning (day 1)	30.24 (7.10)	34.19 (7.73)	34.38 (7.96)	
After fear learning (day 1)	39.48 (8.59)	42.39 (10.91)	43.57 (10.58)	
After intervention (day 1)	30.56 (8.44)	36.54 (10.50)	N/A	
Beginning of day 2	28.40 (6.48)	29.17 (7.26)	33.52 (9.98)	
End of day 2	30.36 (7.48)	31.46 (6.00)	36.16 (10.38)	
<b>Positive Affect</b>				
Before fear learning (day 1)	34.35 (8.41)	29.86 (5.51)	31.41 (7.80)	
After fear learning (day 1)	25.34 (6.23)	24.55 (5.80)	24.23 (9.00)	
After intervention (day 1)	27.67 (7.41)	25.79 (7.28)	N/A	
Beginning of day 2	30.60 (7.34)	30.75 (7.37)	28.26 (7.36)	
End of day 2	25.08 (7.95)	24.45 (5.87)	24.74 (8.42)	
<b>Negative Affect</b>				
Before fear learning (day 1)	12.39 (2.41)	14.41 (4.34)	13.27 (3.45)	
After fear learning (day 1)	17.22 (4.78)	18.96 (6.71)	19.36 (6.54)	
After intervention (day 1)	12.12 (2.26)	15.79 (5.60)	N/A	
Beginning of day 2	11.42 (1.93)	12.67 (4.19)	13.43 (4.03)	
End of day 2	11.92 (3.34)	12.98 (4.82)	14.52 (5.41)	
<b>Shame</b>				
Before fear learning (day 1)	9.48 (13.91)	9.30 (10.00)	15.21 (19.86)	
After fear learning (day 1)	14.52 (16.14)	26.96 (23.36)	28.63 (24.24)	
After intervention (day 1)	5.33 (9.15)	18.61 (20.15)	N/A	
Beginning of day 2	2.84 (4.29)	3.88 (7.01)	8.17 (11.18)	
End of day 2	3.88 (9.07)	4.79 (12.08)	10.00 (13.95)	
<b>Fear</b>				
Before fear learning (day 1)	8.48 (12.99)	14.57 (18.01)	12.13 (16.70)	
After fear learning (day 1)	15.92 (20.74)	24.13 (23.21)	31.83 (26.28)	
After intervention (day 1)	5.17 (10.42)	12.30 (14.76)	N/A	
Beginning of day 2	2.96 (5.95)	6.42 (14.33)	9.00 (17.68)	
End of day 2	5.12 (9.58)	6.25 (15.08)	12.17 (18.16)	
<b>Sadness</b>				
Before fear learning (day 1)	3.28 (4.64)	6.74 (9.04)	11.38 (15.52)	
After fear learning (day 1)	15.36 (20.86)	25.57 (18.37)	39.17 (27.20)	
After intervention (day 1)	3.37 (5.40)	14.61 (17.61)	N/A	
Beginning of day 2	3.64 (6.26)	5.58 (10.36)	10.26 (14.26)	
End of day 2	5.00 (10.74)	4.62 (10.13)	11.35 (14.24)	
<b>Anger</b>				
Before fear learning (day 1)	1.52 (3.31)	5.30 (8.63)	8.42 (13.98)	
After fear learning (day 1)	21.64 (26.41)	33.13 (29.28)	39.37 (32.75)	
After intervention (day 1)	4.13 (6.38)	19.00 (16.58)	N/A	
Beginning of day 2	1.88 (3.86)	4.04 (6.57)	5.87 (13.89)	
End of day 2	5.24 (8.49)	6.58 (10.59)	15.43 (16.48)	

Note. \* $p < .05$ ; \*\* $p < .001$

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Table C.1 (continued)

Measures	Group			Test Statistic
	Rescripting ( <i>n</i> = 26)	Exposure ( <i>n</i> = 24)	Control ( <i>n</i> = 24)	
<b>Disgust</b>				
Before fear learning (day 1)	1.60 (3.62)	4.96 (9.68)	4.42 (6.11)	
After fear learning (day 1)	46.52 (30.74)	53.22 (28.91)	56.79 (33.70)	
After intervention (day 1)	8.83 (11.27)	36.35 (24.78)	N/A	
Beginning of day 2	1.84 (3.80)	4.75 (10.46)	5.96 (10.75)	
End of day 2	3.00 (5.20)	5.04 (8.68)	9.61 (12.10)	
<b>Control</b>				
Before fear learning (day 1)	51.08 (28.62)	64.95 (26.31)	59.75 (26.89)	
After fear learning (day 1)	63.04 (28.94)	53.22 (28.91)	57.36 (29.51)	
After intervention (day 1)	69.63 (27.38)	69.29 (22.51)	N/A	
Beginning of day 2	68.68 (22.47)	67.71 (27.01)	65.87 (24.83)	
End of day 2	65.16 (26.56)	71.96 (23.80)	64.13 (24.12)	
<b>Imagery Exercise</b>				
Pleasantness	2.33 (1.99)	-2.33 (1.47)	N/A	F(1,46) = 85.46**
Vividness	3.67 (1.05)	2.54 (2.48)	N/A	F(1,46) = 4.18*
Valence	2.75 (1.85)	-2.79 (1.56)	N/A	F(1,46) = 126.08**
Intensity	-.71 (2.14)	.83 (2.35)	N/A	F(1,46) = 5.65*
<b>Retro Distress</b>				
After react.	5.52 (2.35)	5.39 (2.06)	N/A	
After intervention 1	3.02 (1.81)	4.39 (2.09)	N/A	
After intervention 2	2.35 (1.87)	3.65 (1.76)	N/A	
<b>SAM<sub>(SAM1-SAM2)</sub></b>				
CS+ Valence	-1.74 (1.56)	-1.33 (2.09)	-1.40 (1.78)	
CS+ Arousal	1.80 (2.00)	1.06 (2.35)	.69 (2.06)	
CS- Valence	1.26 (1.40)	1.58 (1.69)	1.25 (2.01)	
CS- Arousal	-1.28 (1.85)	-1.40 (2.19)	-1.56 (1.42)	

Note. \**p* < .05; \*\**p* < .001

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Table C.2

*Experiment 3: Mixed repeated-measures ANOVA results with between-subjects factor Condition (IR vs. IE vs. Control) and within-subjects factors Stimulus (CS+ vs. CS-) and Trial for subjective distress*

	<i>F</i>	<i>df</i>	<i>p</i>	$\eta_p^2$
<b>(a) CS baseline</b>				
Stimulus	10.34	1, 70	<b>.002</b>	.13
Stimulus × Condition	0.19	2, 70	.826	.01
Condition	2.68	2, 70	.076	.07
<b>(b) Acquisition (Acq 1 to Acq 3)</b>				
Stimulus	128.65	1, 70	<.001	.65
Stimulus × Condition	0.39	2, 70	.676	.01
Trial	1.22	1, 70	.272	.02
Trial × Condition	2.25	2, 70	.113	.06
Stimulus × Trial	5.32	1, 70	<b>.024</b>	.07
Stimulus × Trial × Condition	2.01	2, 70	.142	.05
Condition	0.97	2, 70	.386	.03
<b>(c) Retention test (Acq 3 vs Test)</b>				
Stimulus	97.36	1, 70	< <b>.001</b>	.58
Stimulus × Condition	0.05	2, 70	.949	<.01
Trial	19.21	1, 70	<.001	.23
Trial × Condition	0.31	2, 70	.733	<.01
Stimulus × Trial	23.20	1, 70	< <b>.001</b>	.25
Stimulus × Trial × Condition	0.04	2, 70	.963	<.01
Condition	0.90	2, 70	.410	.03
<b>(d) Transfer test (Test)</b>				
Stimulus	66.66	1, 70	< <b>.001</b>	.49
Stimulus × Condition	0.03	2, 70	.973	<.01
Condition	0.75	2, 70	.475	.02
<b>(e) Reinstatement (Test vs Ext 1/2)</b>				
Stimulus	81.82	1, 70	<.001	.54
Stimulus × Condition	0.03	2, 70	.970	<.01
Trial	8.80	1, 70	.004	.11
Trial × Condition	0.09	2, 70	.916	<.01
Stimulus × Trial	7.22	1, 70	<b>.009</b>	.09
Stimulus × Trial × Condition	0.61	2, 70	.547	.02
Condition	0.90	2, 70	.413	.03
<b>(f) Extinction (all trials)</b>				
Stimulus	75.21	1, 70	<.001	.52
Stimulus × Condition	0.88	2, 70	.419	.03
Trial	42.31	2.52, 176.21	<.001	.38
Trial × Condition	0.88	5.04, 176.21	.500	.02
Stimulus × Trial	15.17	1.99, 139.37	<.001	.18
Stimulus × Trial × Condition	0.57	3.98, 139.37	.684	.02
Condition	0.24	2, 70	.786	.01
<b>(g) Extinction (Ext 19/20)</b>				
Stimulus	35.75	1, 70	< <b>.001</b>	.34
Stimulus × Condition	0.82	2, 70	.447	.02
Condition	0.23	2, 70	.798	.01

*Note.* Significant *p*-values relevant for the interpretation of the results are marked bold.

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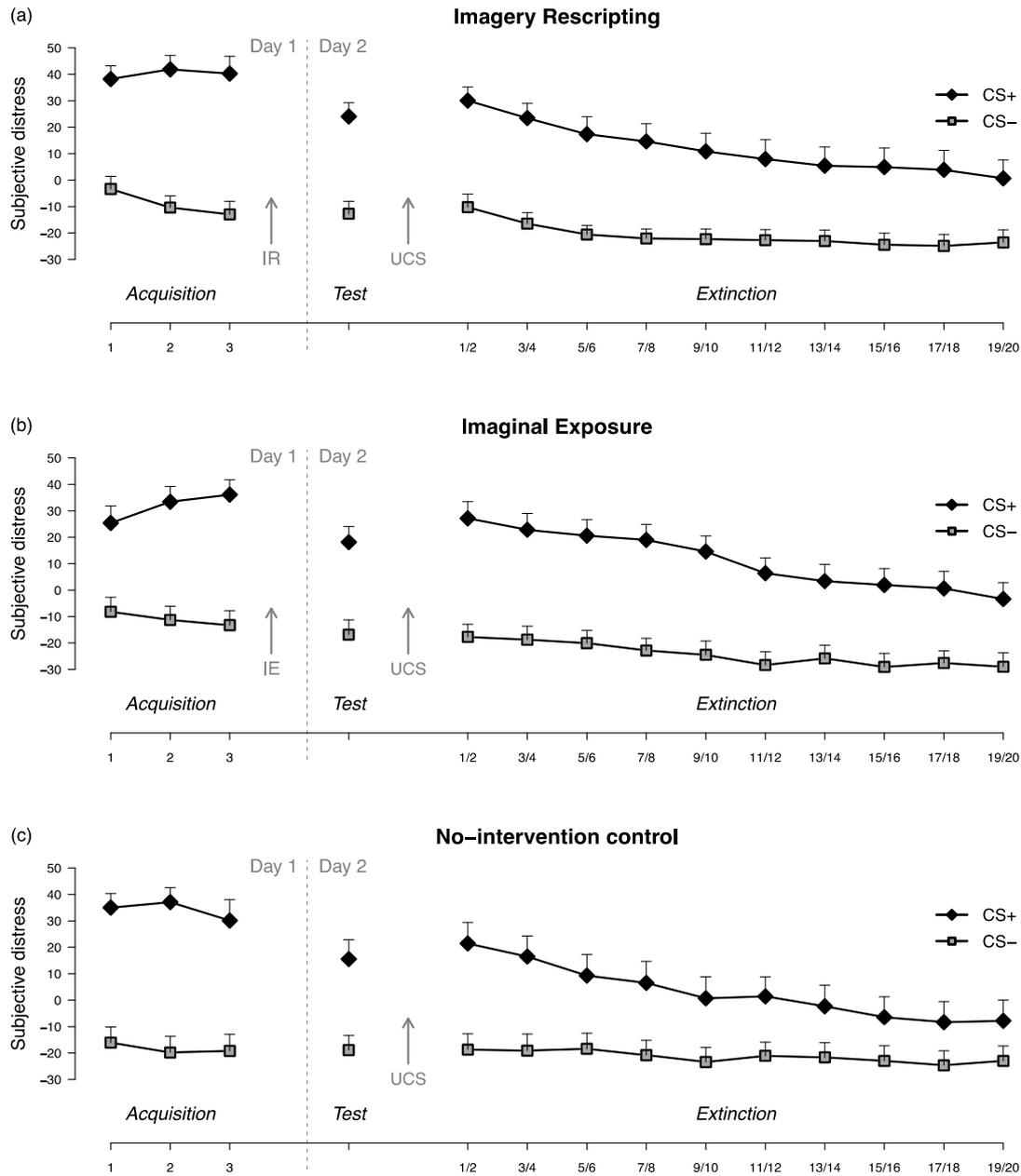


Figure C. Experiment 3: Mean subjective distress responses to CS+ and CS- during fear acquisition, test, reinstatement, and extinction for the (a) imagery rescripting (IR), (b) imaginal exposure (IE), and (c) no-intervention control condition. Error bars represent SEM.

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