



A09: The influence of stress and stress hormones on extinction, renewal, reinstatement and reconsolidation PI: Oliver T. Wolf and Christian J. Merz

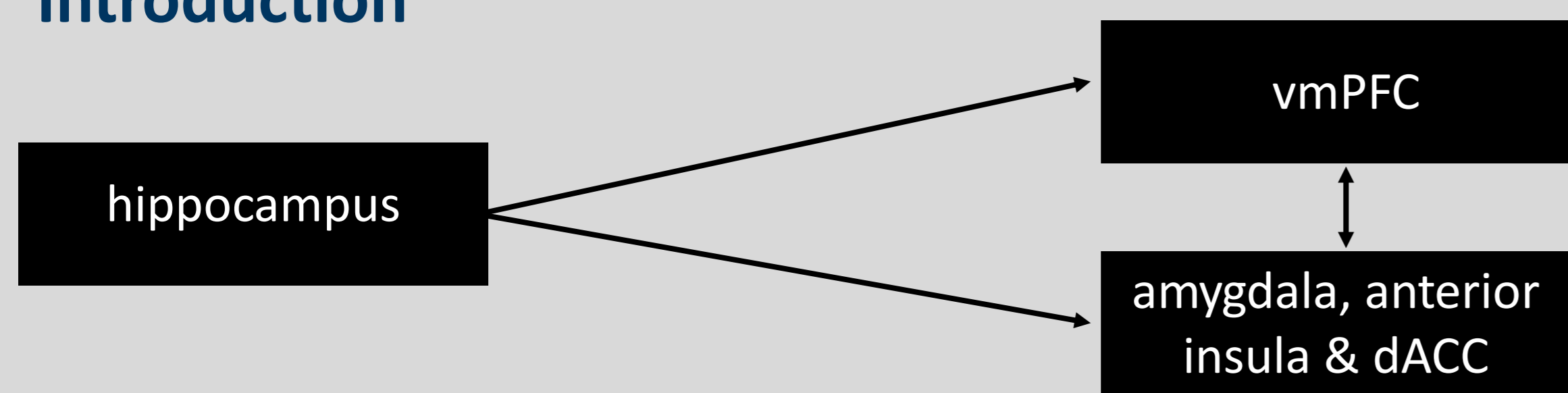
# The neural underpinnings of stimulus-based extinction generalization

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## Introduction



Proposed mechanism of stimulus-based extinction generalization based on the neural model of conditioned fear generalization by Lissek et al. (2014): Extinction generalization might lead to reduced pattern separation in the hippocampus which reduces activation in the fear network.

- using multiple similar extinction stimuli results in a generalized extinction memory trace reflected in attenuated return of fear (Zbozinek & Craske, 2018) to related but former unrepresented stimuli (Rowe & Craske, 1998) and contexts (Shiban et al., 2015)
- although mechanisms of fear generalization (Lissek et al., 2014) have been addressed, the neural underpinnings of stimulus-based extinction generalization remain elusive

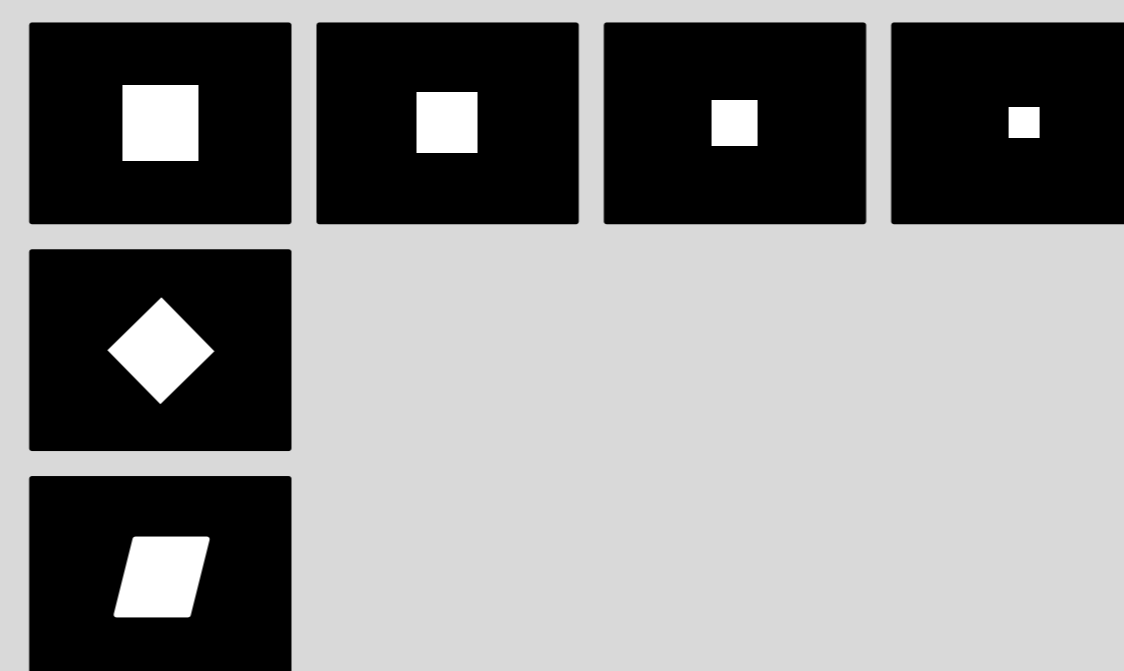
## Methods

### Day 1: Fear acquisition training



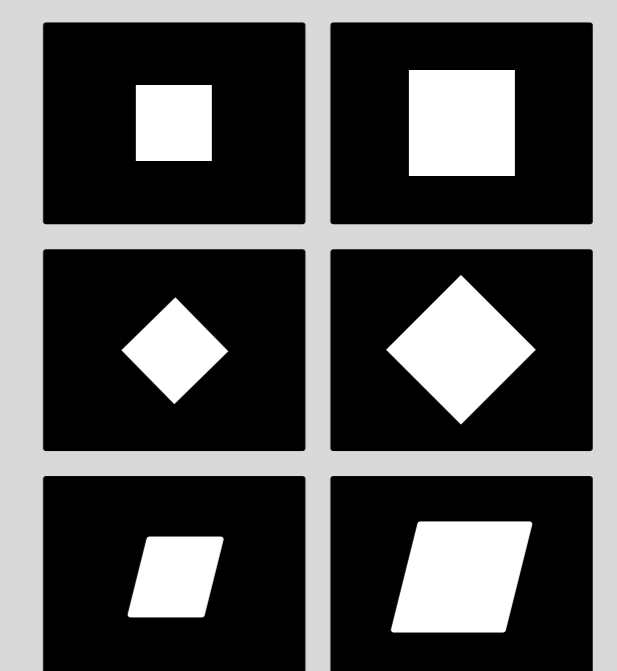
- 62.5% partial reinforcement for the two CS+
- UCS: 100ms electrical stimulation

### Day 2: Extinction training



- one CS+ is generalized extinguished (presented in multiple smaller sizes; CS+G)
- the other CS+ (and CS-) is extinguished in its original size (CS+N)

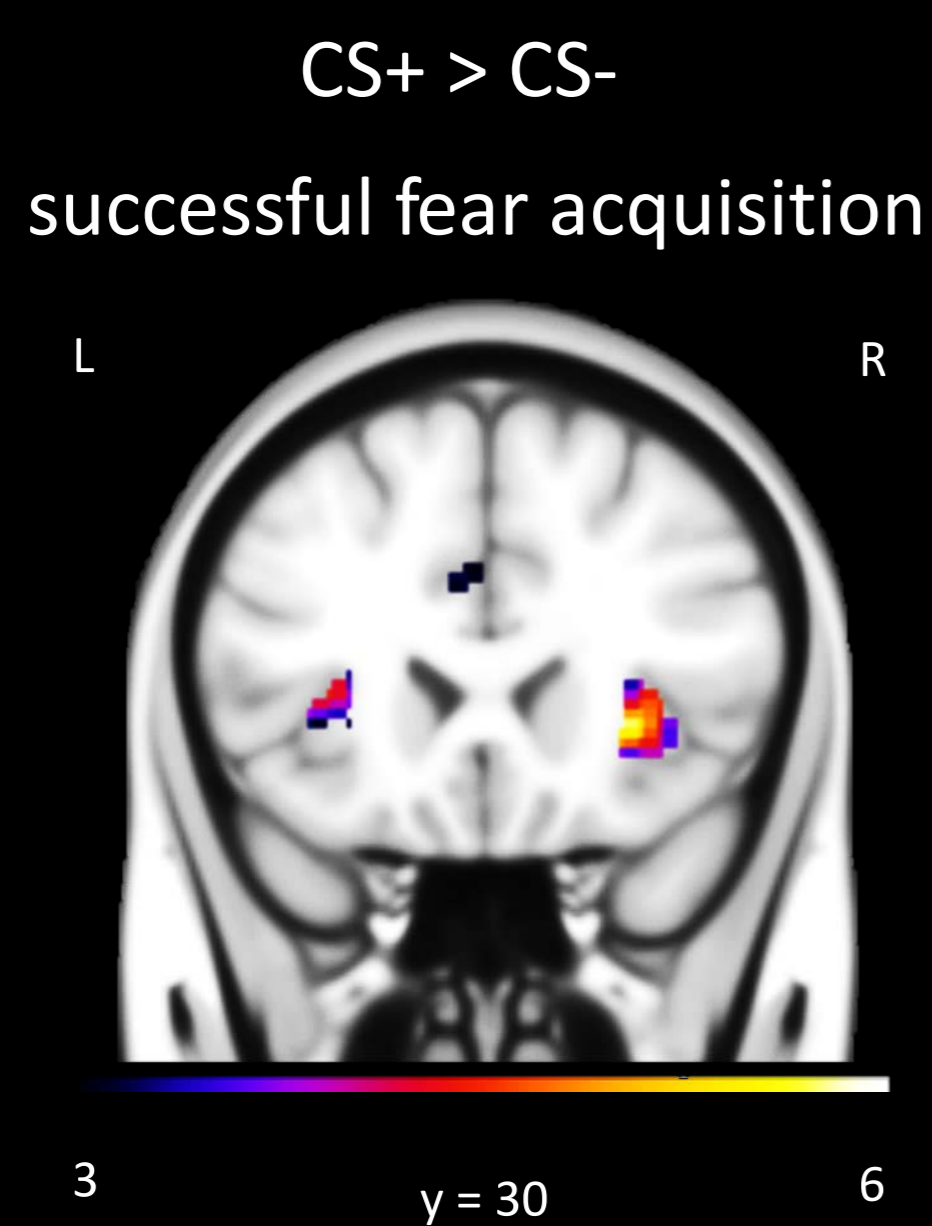
### Day 3: Recall



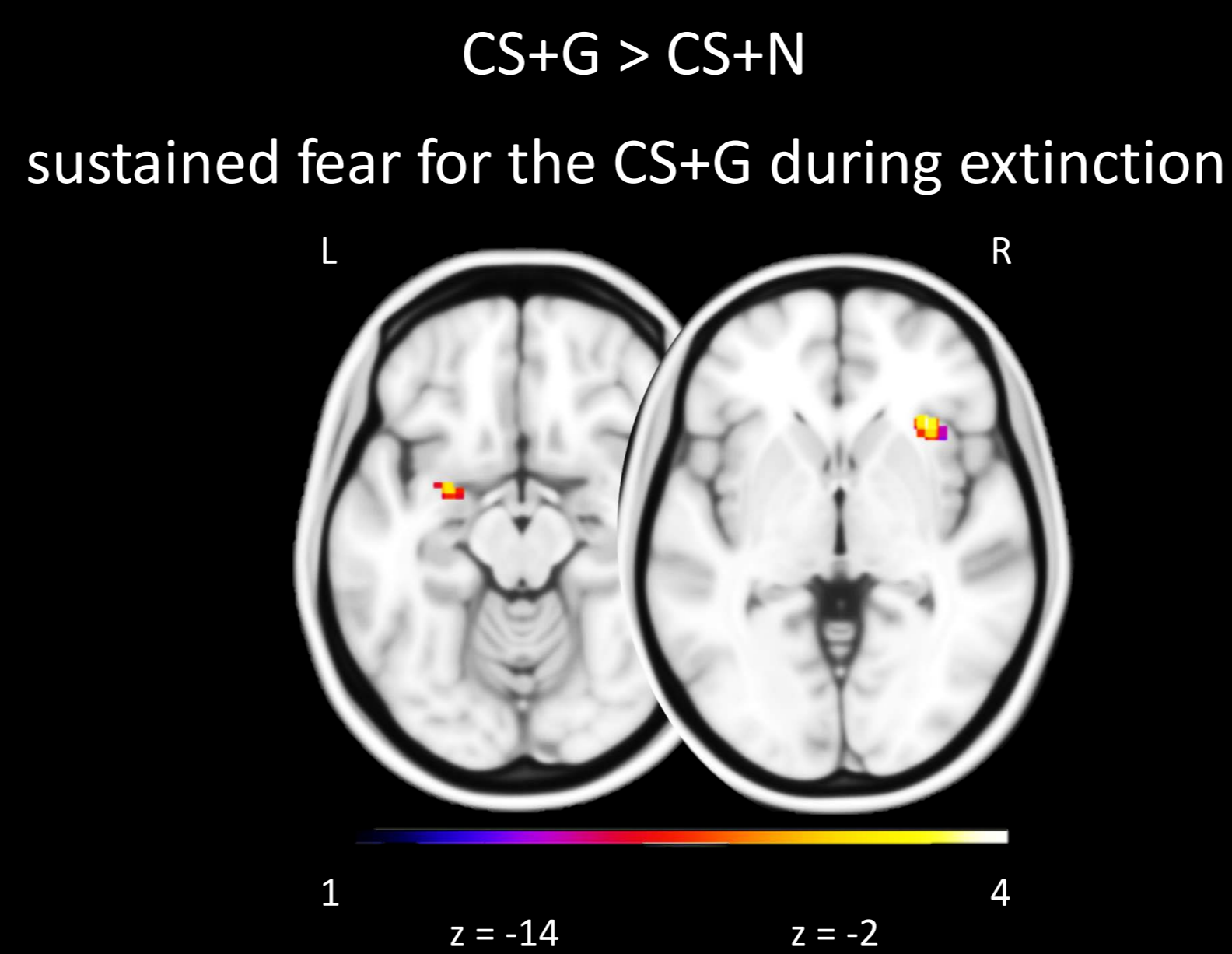
- each CS is presented in its original and one greater (generalization) size

## Results

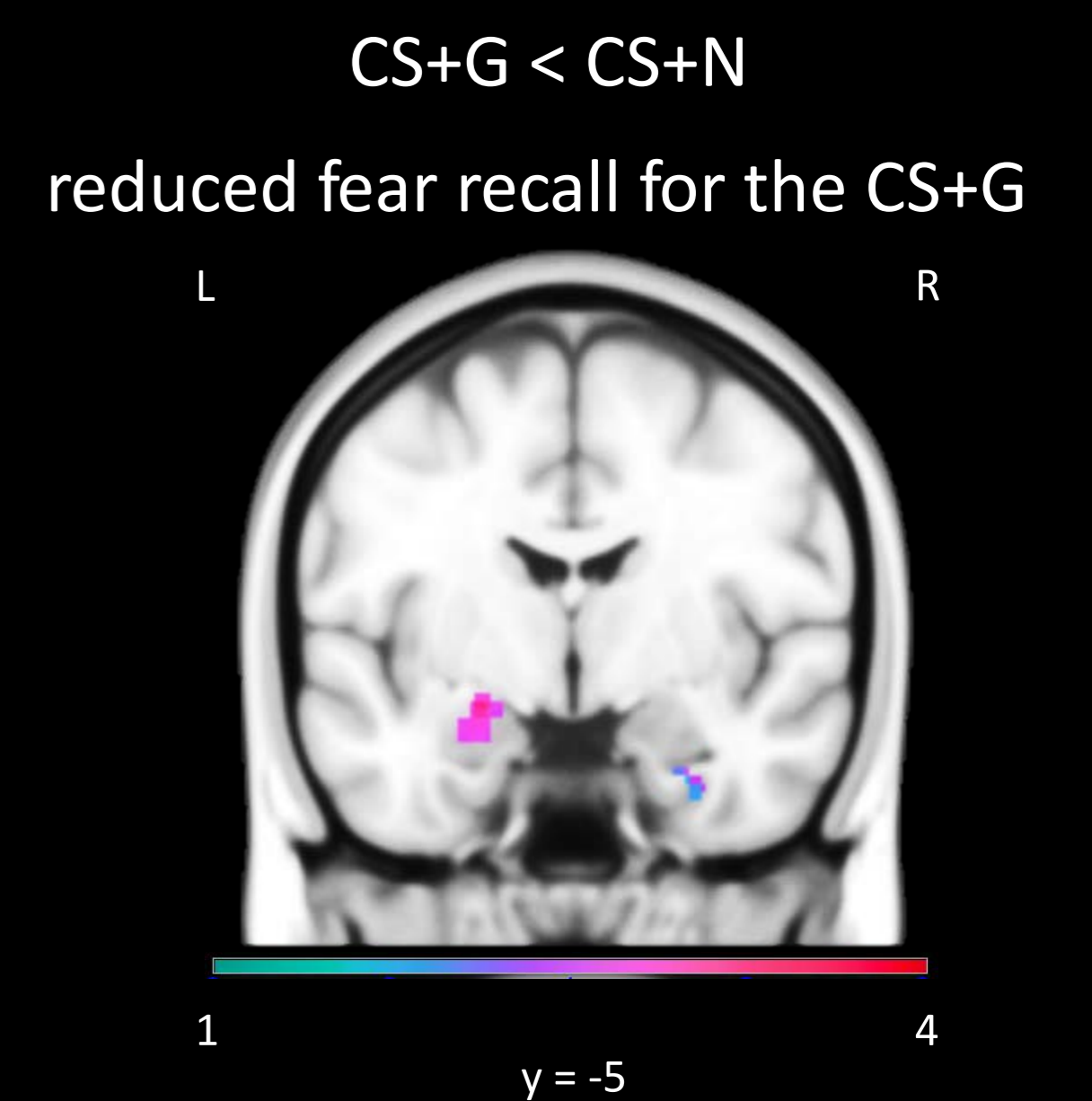
### fMRI



- increased bilateral **anterior insula**, **amygdala** and **dACC** activation
- increased right **hippocampus** activation

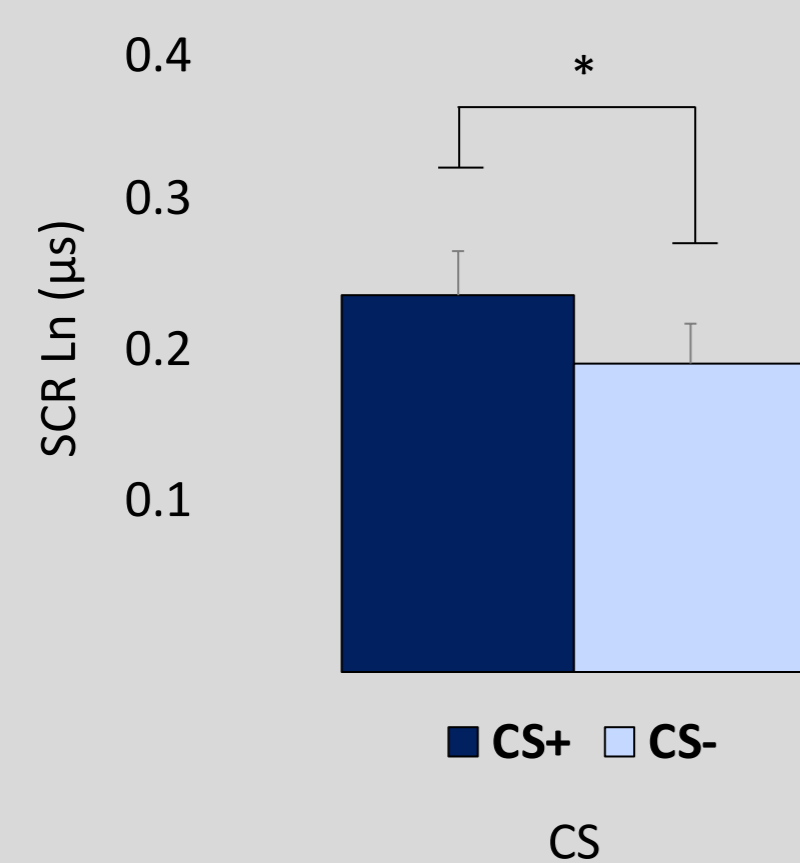


- first half: increased **left amygdala** activation and decreased **vmPFC** activation
- second half: increased **right insula** activation

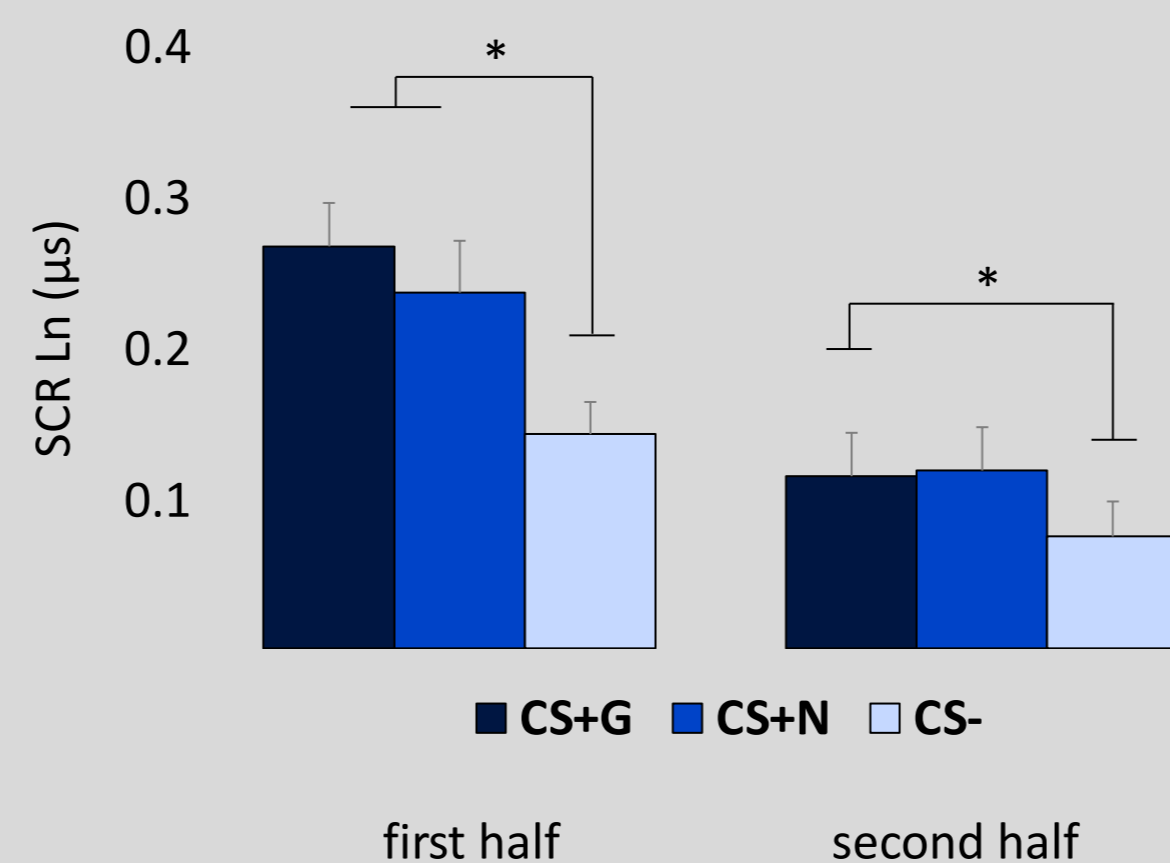


- decreased activation of the **left amygdala** and **right PHG**

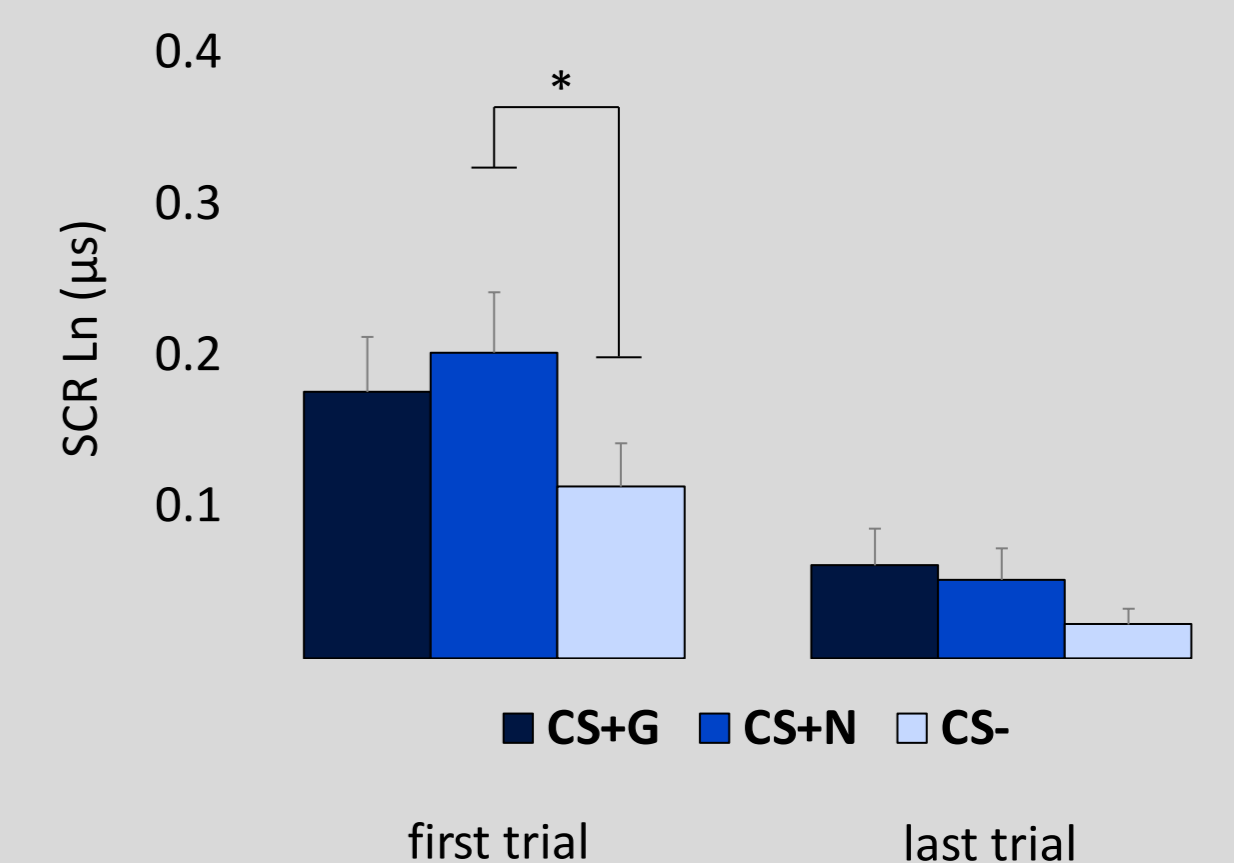
### SCR



- significantly higher SCRs for CS+ compared to CS-



- first half: significantly higher SCRs for CS+G and CS+N compared to CS-
- second half: significantly higher SCRs for CS+G compared to CS-



- significantly increased SCRs for the CS+N compared to CS- at the beginning of recall

## Discussion

- prolonged fear expression to the CS+G (reflected in enhanced amygdala and insula activation as well as decreased vmPFC activation) during extinction learning has beneficial effects on the return of fear
- this effect might rely on enhanced variability during extinction training and the resulting increased salience and expectancy violation (Craske et al., 2014)
- generalized extinction led to attenuated fear reflected in amygdala signaling and SCRs during recall, representing one potential strategy to be incorporated in exposure therapy to reduce relapses (Craske, Hermans & Vervliet, 2018)