

# No Stress With Perceptual Learning

Aaron Clarke<sup>1</sup>, Kristoffer C. Aberg<sup>2</sup>, Carmen Sandi<sup>1</sup> and Michael H. Herzog<sup>1</sup>

<sup>1</sup> Brain Mind Institute, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

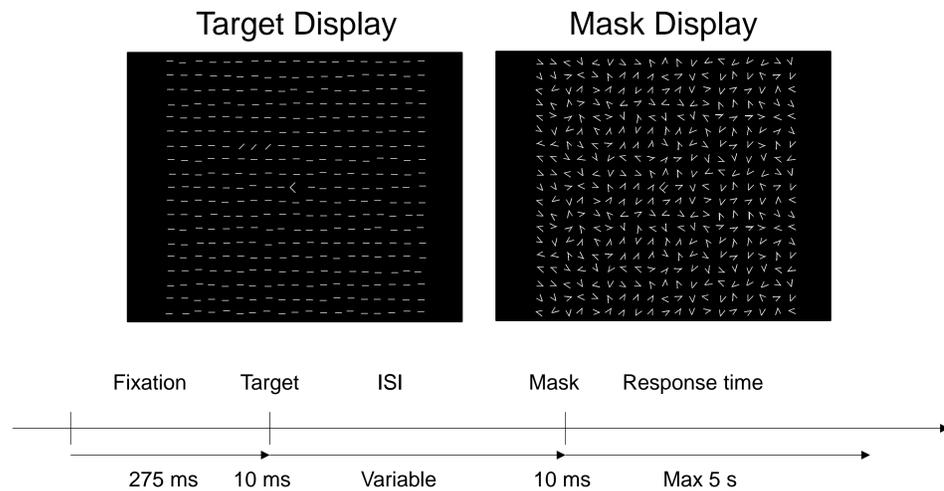
<sup>2</sup> Neurology and Imaging of Cognition Lab, University of Geneva, Switzerland

## Introduction:

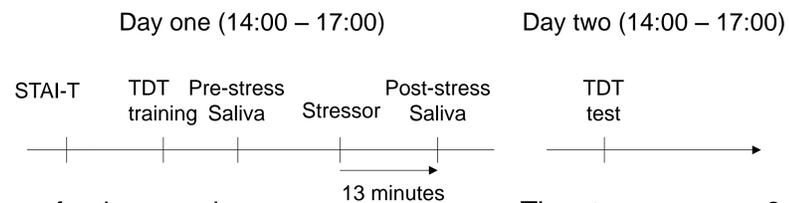
Stress affects memory formation. For example, stress is facilitative or detrimental to declarative memories, depending on stressor severity and time course. For non-declarative memories, however, the role of stress is less studied. Here, we investigated the effects of stress on perceptual learning using a texture discrimination task.

## Texture discrimination task

- Participants judged the orientation of a target patch (horizontal or vertical) against a background of distracters (Figure 1).
- To ensure fixation, participants judged whether a centrally fixated letter was a "T" or an "L".
- Task difficulty was modulated by varying the inter-stimulus interval (ISI) between the target and a mask (shorter ISI's mean better performance).



**Figure 1.** Texture discrimination task (TDT)

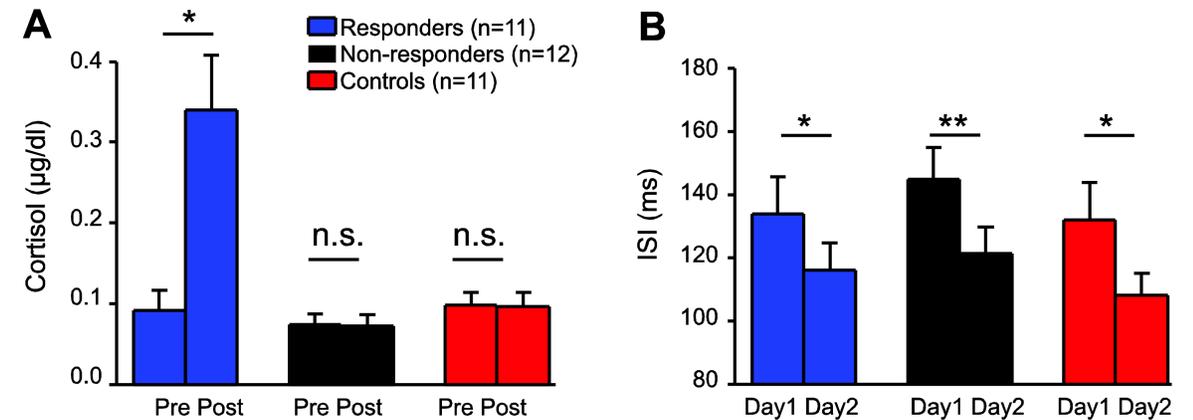


**Figure 2.** Time course for the experiment.

1. State Trait Anxiety Inventory (STAI-T)
2. TDT training
3. Pre-stressor saliva sample to measure cortisol levels ( $\mu\text{g}/\text{dl}$ )
4. Stressor
5. Post-stressor saliva sample
6. On Day two, TDT testing re-test

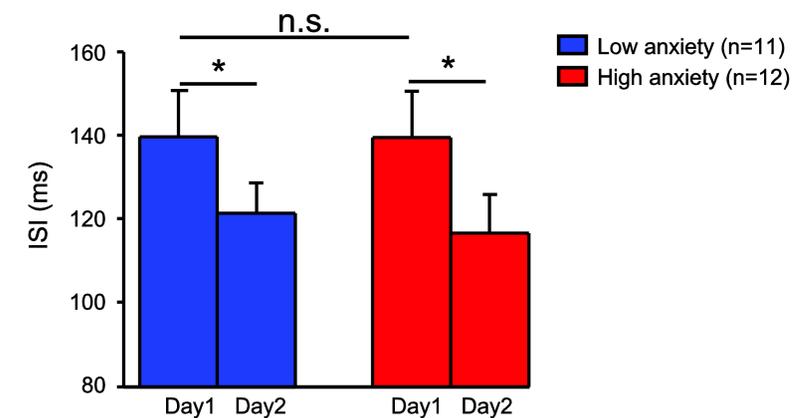
- The stressor was a 3 minute forearm immersion in either ice water (0-4°C) or lukewarm water (37-40°C).
- In order to ensure maximal stressor effectiveness, participants were told before the experiment that they would be randomly assigned to either the stress or the no-stress group and that they would not find out which group they were in until the "stressor" phase.

## Results:



**Figure 3. A:** Within the stress group there were responders (blue) and non-responders (black). Only responders showed an increase in cortisol levels from the pre- to post-stressor saliva samples. **B:** For all three groups performance improved – but it did so for all groups similarly (responders, non-responders and controls). Thus, stress-induced increases in cortisol levels had no significant effect on perceptual learning. (\* $p < .05$ , \*\* $p < .01$ ).

## Does trait anxiety modulates responsiveness to stress?



**Figure 4.** The stressed group was divided into a high and a low anxiety group based on a median split of STAI-T scores. Performance levels for high- and low-trait anxiety participants were similar.

## Conclusions:

- Stress does not affect perceptual learning
- Trait anxiety does not modulate perceptual learning