



# The Neural Outcomes of Emotional Regulation Following Mindfulness Based Stress Reduction Training

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## Background

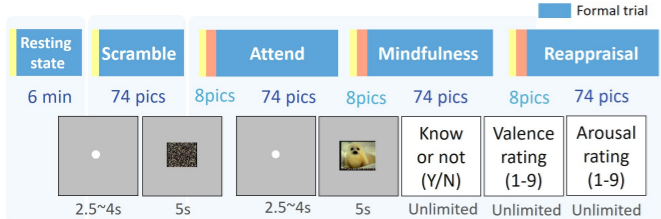
- Mindfulness-based Stress Reduction (MBSR) showed improved mental health outcomes and emotion regulation capability [1] [2]
- Psychological and neurophysiological models have been proposed to explain why MBSR and other mindfulness-based training influences emotion regulation [3]
- Few studies directly focused on examining how mindfulness training leverage the temporal process of emotion regulation strategies
- We investigated MBSR training effects on the neural temporal process of mindfulness and reappraisal emotion regulation strategies

## Methods

- 27 participants (aged 42.26 ± 7.81 years; 24 females)
- **Emotion Regulation Task:** participants viewed 222 positive and negative pictures from International Affective Picture System (IAPS) in Scramble, Attend, Mindfulness, Reappraisal conditions for 5s and rated emotional arousal and valence after Attend, Mindfulness and Reappraisal

Condition	Picture type	Viewing way
Scramble	Shuffled-pixel	Passive viewing
Attend	Emotional	Passive viewing
Reappraisal	Emotional	Detach from oneself
Mindfulness	Emotional	Observing sensation, emotion, thoughts

## Task Procedure

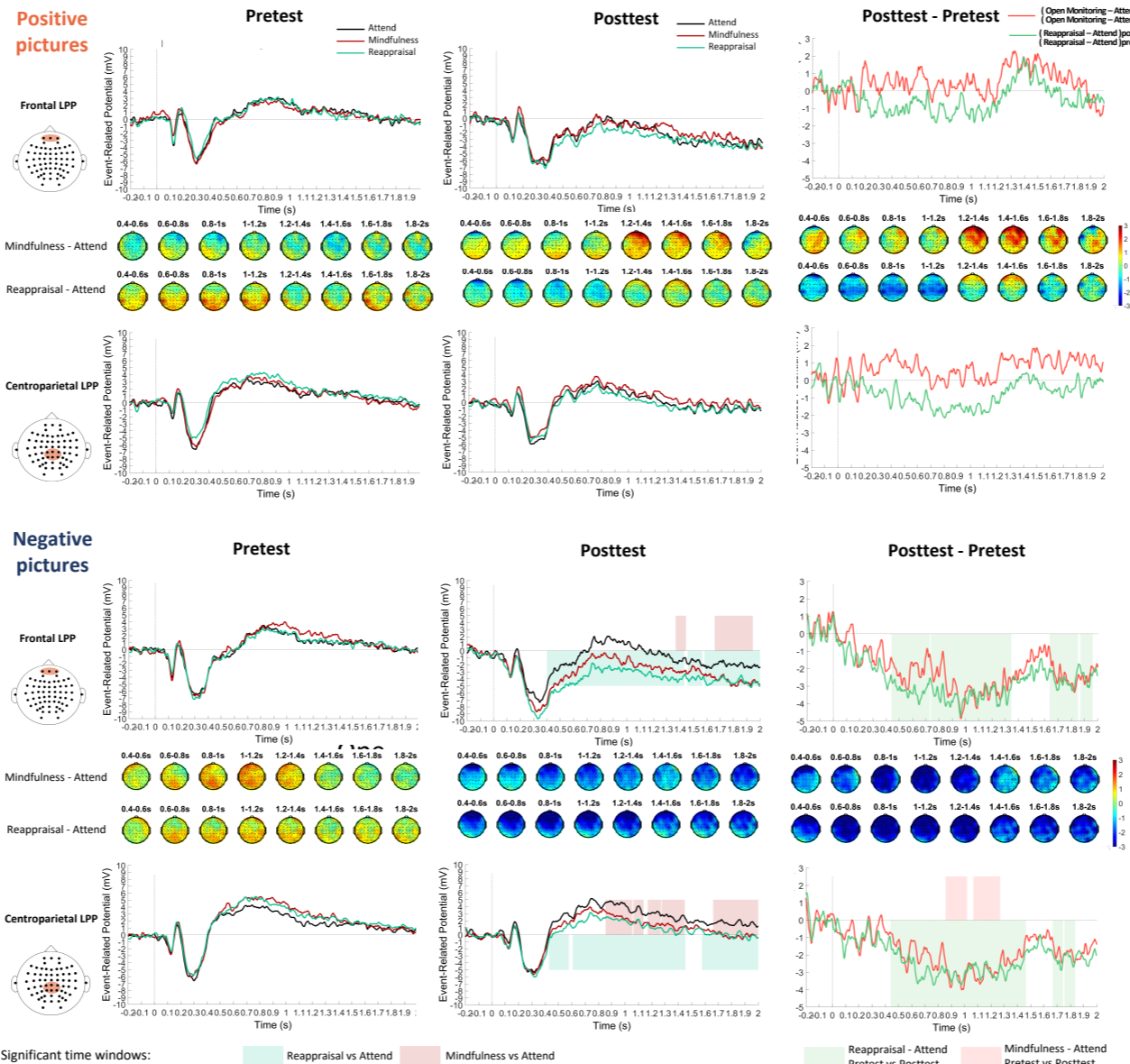


## Data Analysis

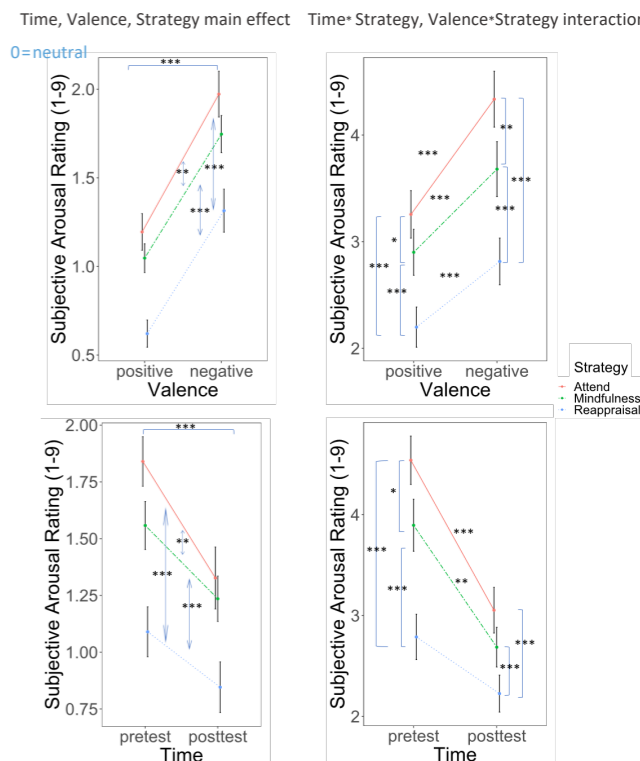
- ANOVA
  - Dvs: **Valence to neutral (1-4), Arousal (1-9)** of subjective rating
  - Ivs: **Strategy**(Attend, Mindfulness, Reappraisal), **Time**(pretest, posttest) **Valence**(positive, negative pictures)
- EEG recordings: 64 channels ( Neuroscan 10/20 system )
- ERP: centroparietal LPP (CP1, CP2, P1, P2): emotion reactivity  
frontal LPP (F1, F2): cognitive effort
- Planned cluster-based permutation t-tests: ERPs in Mindfulness vs. Attend and Reappraisal vs. Attend respectively in different valenced pictures (positive/ negative) and different timepoints ( pretest/ posttest)

## Results

### MBSR has training effect on reducing LPP towards negative pictures



### MBSR makes valence more neutral



## Conclusion

- MBSR regulated neural process underlying emotion regulation
- Reappraisal showed obvious regulatory effect on centroparietal/ frontal LPP through MBSR
- Mindfulness showed moderate regulatory effect on centroparietal but not frontal LPP through MBSR
- MBSR shifted emotional valence to neutral
- MBSR decreased emotional arousal
- MBSR showed large training effect on reappraisal after 8 weeks while mindfulness may need longer term practice to make effect come off

## References

1. Khoury, B., Sharma, M., Rush, S.E., & Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *Journal of Psychosomatic Research*, 78(6), 519–28. <https://doi.org/10.1016/j.jpsychores.2015.03.009>

2. Hölzel, B. X., Brunsch, V., Gard, T., Greve, D. N., Koch, K., Sorg, C., Lazar, S. W., & Milad, M. R. (2016). Mindfulness-Based Stress Reduction, Fear Conditioning, and The Uncinate Fasciculus: A Pilot Study. *Frontiers in Behavioral Neuroscience*, 10, 124. <https://doi.org/10.3389/fnbeh.2016.00124>

3. Greccucci, A., Allard, E. S., Guendelman, S., Guendelman, S., Mulderos, S., & Rampes, H. (2017). *Mindfulness and Emotion Regulation: Insights from Neurobiological, Psychological, and Clinical Studies*. <https://doi.org/10.3389/fpsyg.2017.00220>

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