

Inducing and Regulating Anger and Sadness in Delegated Driving: An In-Car Experiment

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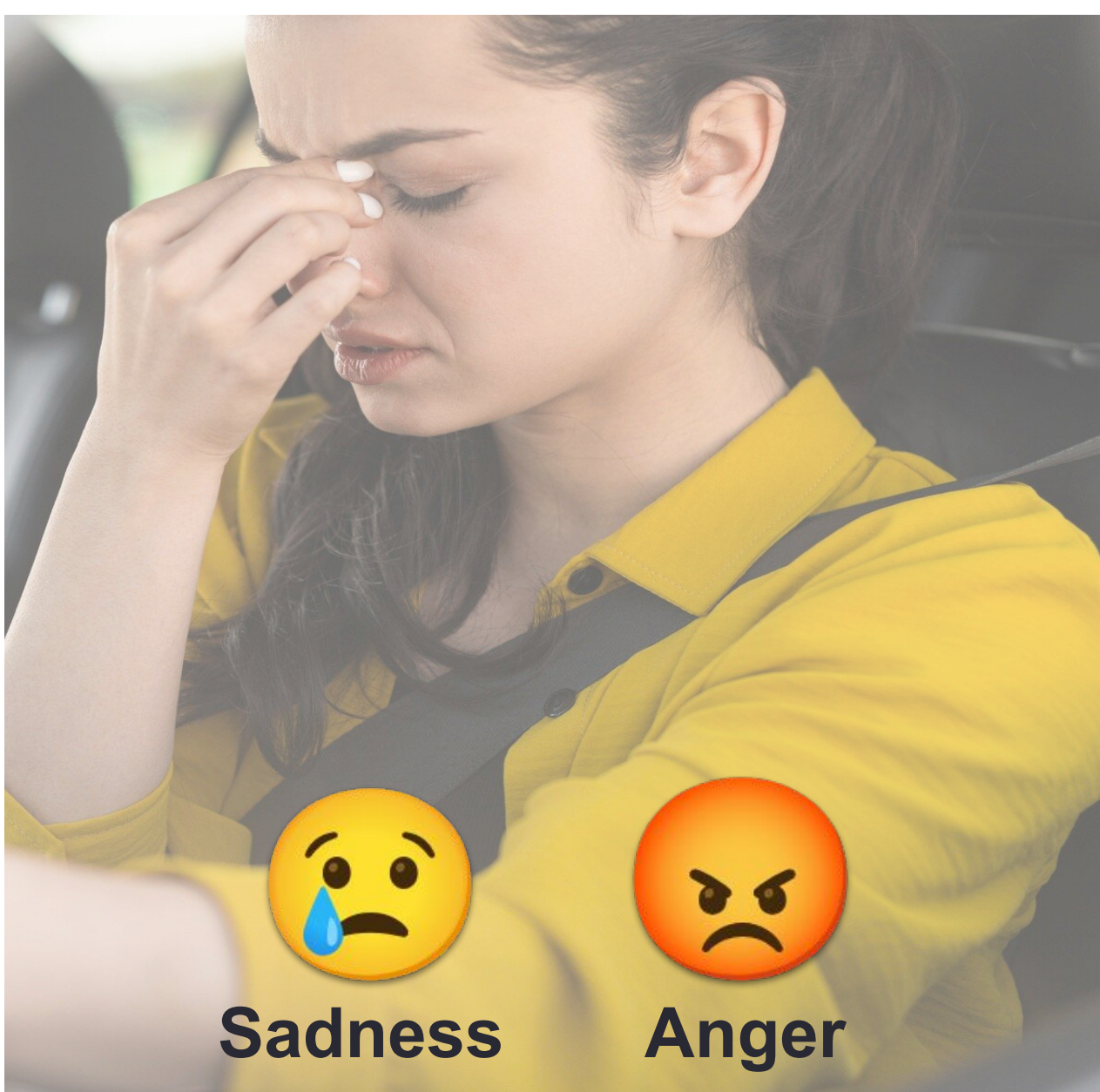


Introduction

- Sadness**-related ruminations increase **inattention**, raising the risk of at-fault **accidents** (Lagarde et al., 2004).
- Drivers focused on **negative thoughts** report higher likelihood of **aggressive behavior** (Suhr, 2016).
- Delegated driving** can intensify **mind-wandering** (Gouraud et al., 2018) and the emergence of **negative thoughts** (Walker & Trick, 2018), making **emotional state monitoring and regulating essential**.
- Anger** raises heart and breathing rates, while **sadness** reduces them (Kreibig, 2010).
- Breathing techniques** can reduce anxiety (Costa et al., 2016) and may help **manage anger and sadness**, though they have **not been tested in delegated driving in real car**.

Objectives

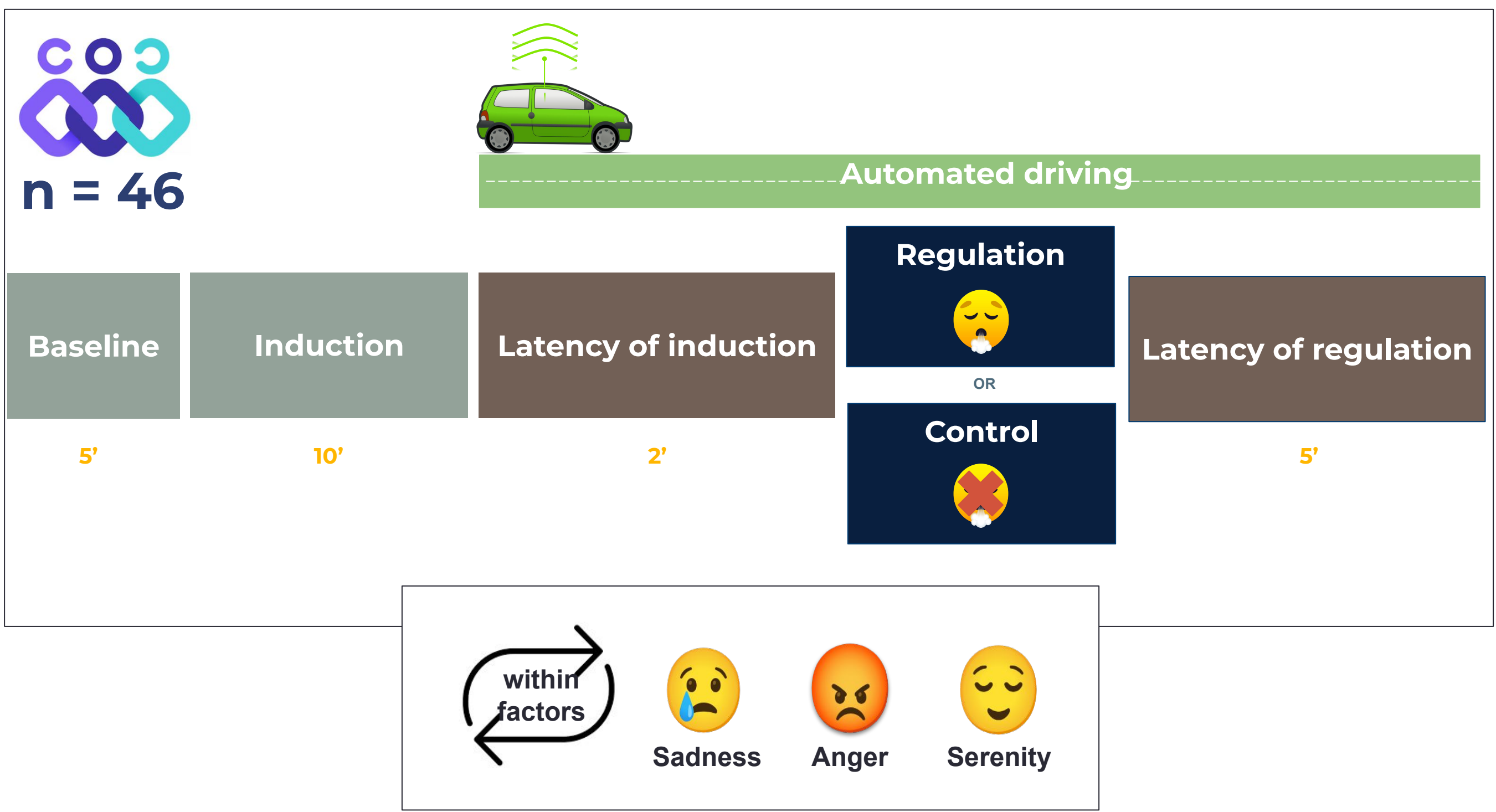
How to detect & regulate negative emotional thoughts ?



In-car delegated driving experiment



Methods



- Induction:** Writing a personal memory related to sadness, anger or serenity.
- Regulation:** Guided respiration (5 rsp per minute).

Results

- Median split groups:** To mitigate the issue of emotional blunting effect, for each emotion we recreated two groups (induced (e.g., anger) vs. non-induced (control) on the basis of a median split calculated with the subjective scores.
- Angry** ($p < .05$) and **sad** ($p = .07$) individuals had a **higher mean respiratory RMSSD** than non-angry and non-sad individuals after emotional induction. There is no longer difference in latency of regulation.

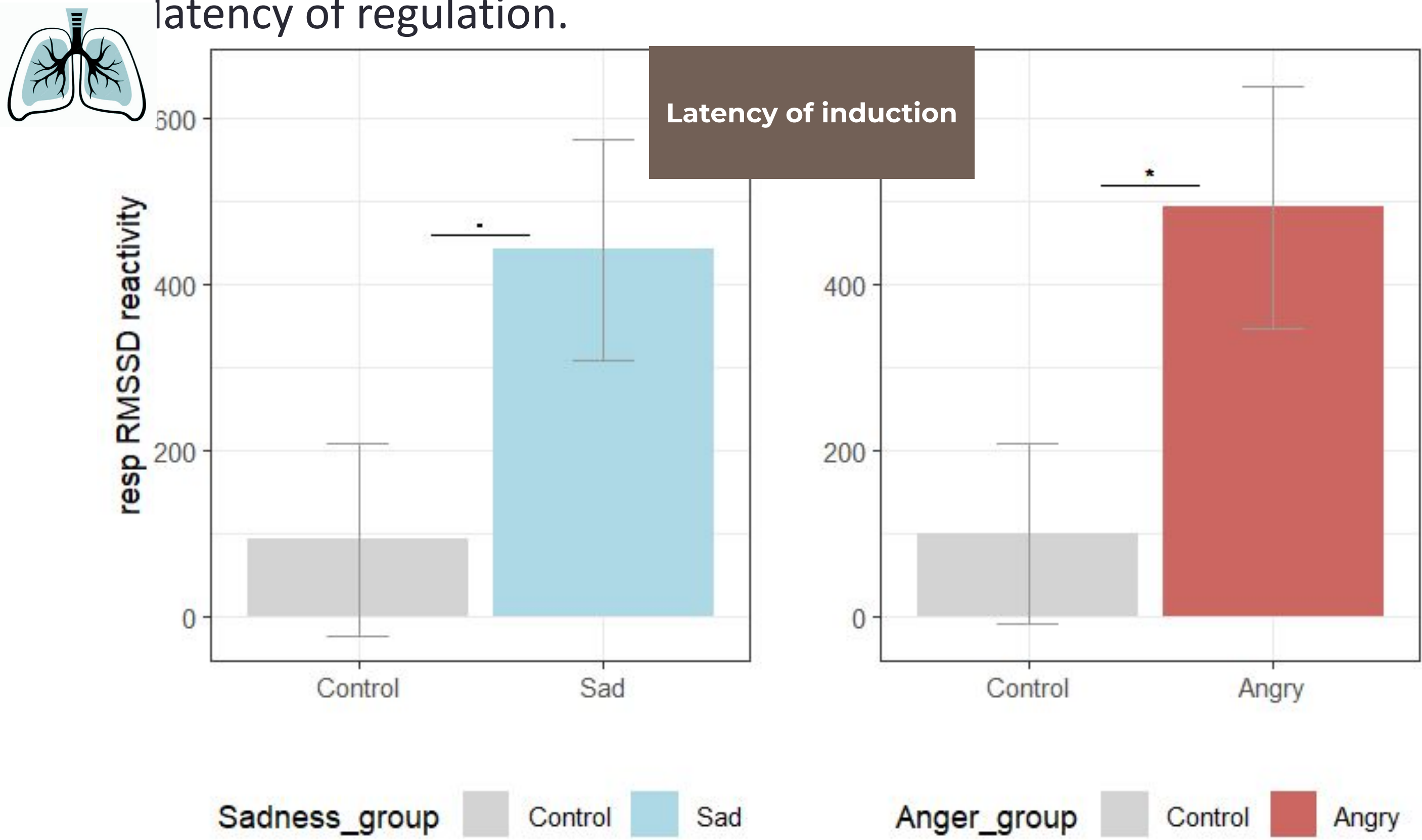


Figure 1. Means of respiratory RMSSD reactivity (in ms) during the latency of induction according to the sadness group (sad/control) and the anger group (angry/control). * $p < 0.05$; < 0.10 .

- Angry individuals** had a **higher mean cardiac RMSSD** than non-angry individuals during the regulation

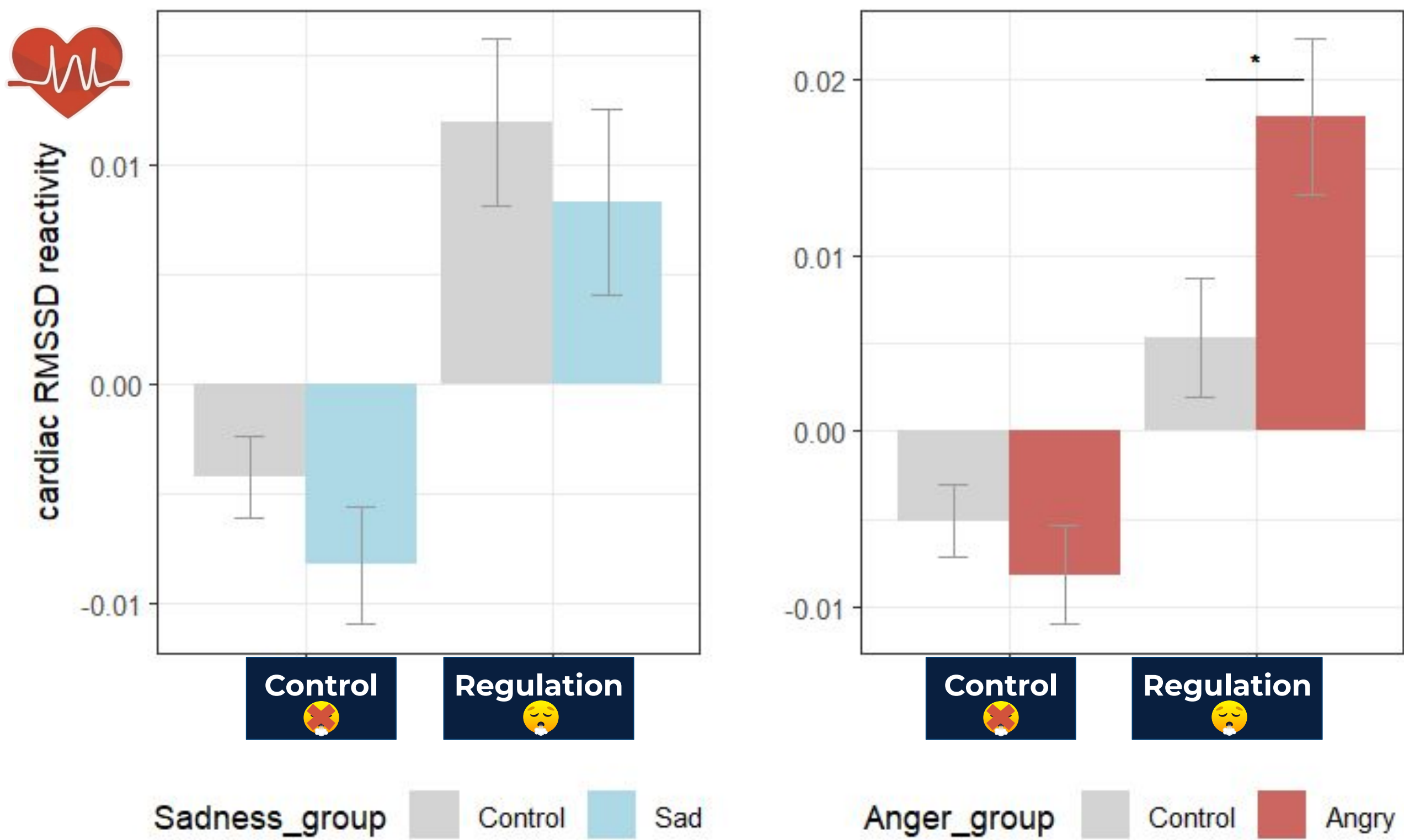


Figure 2. Means of cardiac RMSSD reactivity (in ms) during the latency of induction according to the sadness group (sad/control) and the anger group (angry/control). * $p < 0.05$.

- Sad individuals** had a **greater mean respiratory amplitude** than non-sad individuals during the regulation.

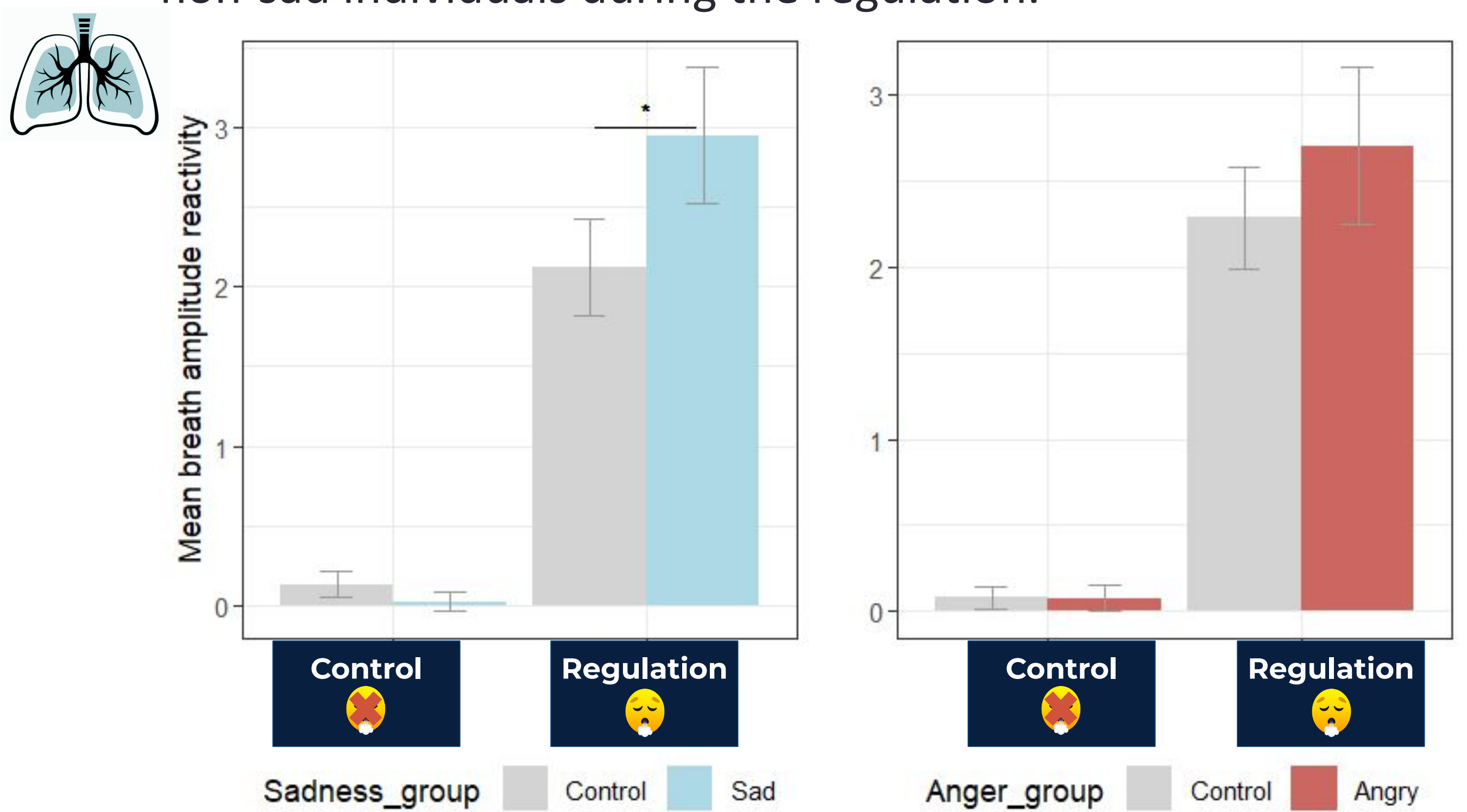


Figure 3. Means of breath amplitude reactivity during the regulation or control session according to the sadness (control and sad) and anger (control, angry) groups. * $p < 0.05$.

Conclusions

- Angry and sad individuals** showed **increased respiratory variability** after **emotional induction**, likely reflecting **autoregulation**.
- The **effects of emotional induction faded over time**, whether or not the breathing exercise was performed.
- However, angry and sad individuals** had a **specific cardiac and respiratory signature during regulation** (breathing exercise).

References

Costa, J., Adams, A. T., Jung, M. F., Guimbretière, F., & Choudhury, T. (2016). EmotionCheck : Leveraging bodily signals and false feedback to regulate our emotions. *Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 758-769.

Gouraud, J., Delorme, A., & Berberian, B. (2018). Influence of automation on mind wandering frequency in sustained attention. *Consciousness and cognition*, 66, 54-64.

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological psychology*, 84(3), 394-421.

Lagarde, E., Chastang, J.-F., Gueguen, A., Coeurat-Pellier, M., Chiron, M., & Lafont, S. (2004). Emotional Stress and traffic accidents: The impact of separation and divorce. *Epidemiology*, 15(6), Article 6.

Suhr, K. A. (2016). Musing over anger: Indirect and conditional indirect effects of thought content and trait rumination on aggressive driving. *Transportation research part F: traffic psychology and behaviour*, 42, 276-285.

Walker, H. E., & Trick, L. M. (2018). Mind-wandering while driving: The impact of fatigue, task length, and sustained attention abilities. *Transportation research part F: traffic psychology and behaviour*, 59, 81-97.

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