

Sex Differences in Pain Memory and Contextual Processing: A Virtual Reality Study of Pain Conditioning

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INTRODUCTION

Pain acts as a vital alarm system, signalling potential threats to bodily integrity. Its perception is strongly shaped by contextual factors (emotional or environmental), which influence how pain is encoded in both conscious and unconscious long-term memory¹.

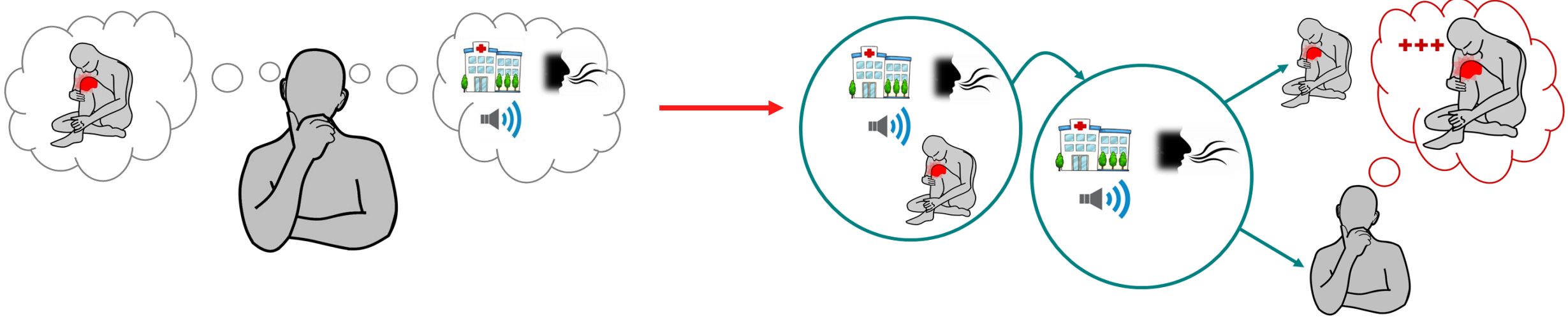
When pain is experienced as traumatic, it may increase the risk of developing chronic pain by triggering conditioned fear responses². These responses can generalize to similar non-threatening stimuli, reinforcing maladaptive fear, maintaining distress, and discouraging engagement with safe but contextually related environments³.

Despite this, the role of context in the consolidation and reactivation of painful memories remains poorly understood.

AIM

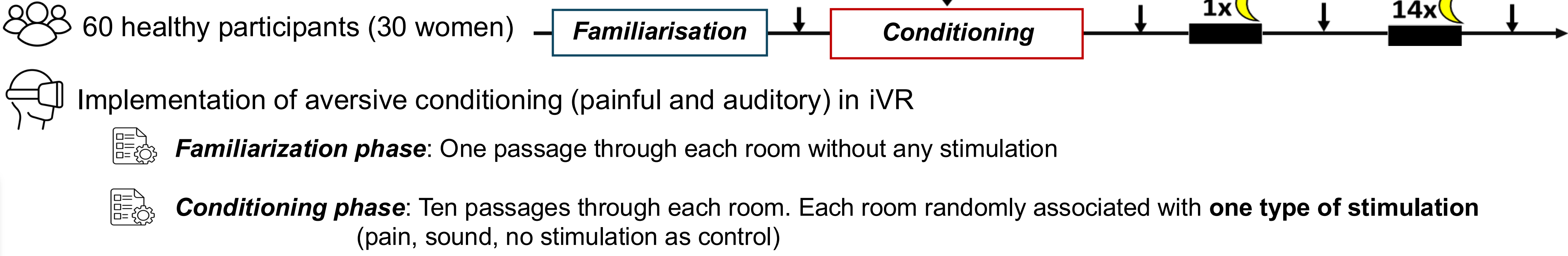
Understand how pain conditioning can modulate:

- (1) The perception of the pain associated context
- (2) The long-term memory of pain



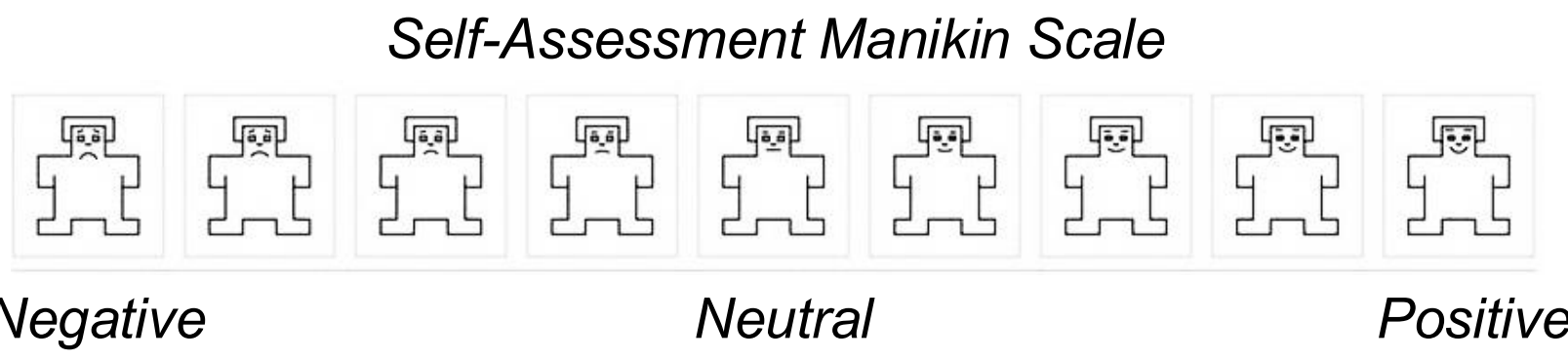
METHODS

Experimental protocol

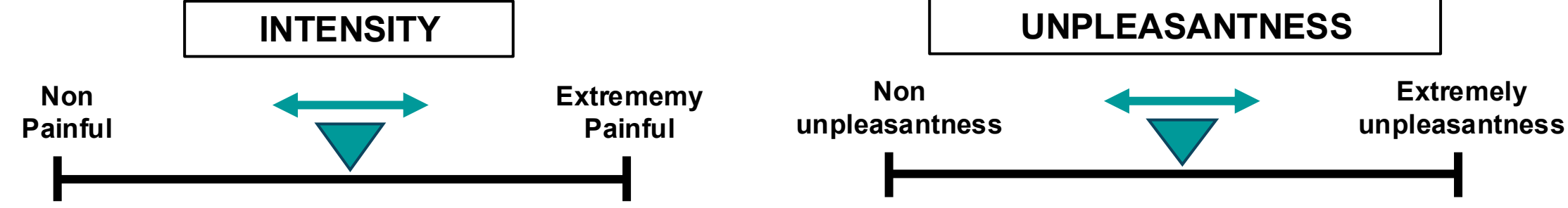


Behavioral measures

Perception of the contextual environment (Valence – VAL)



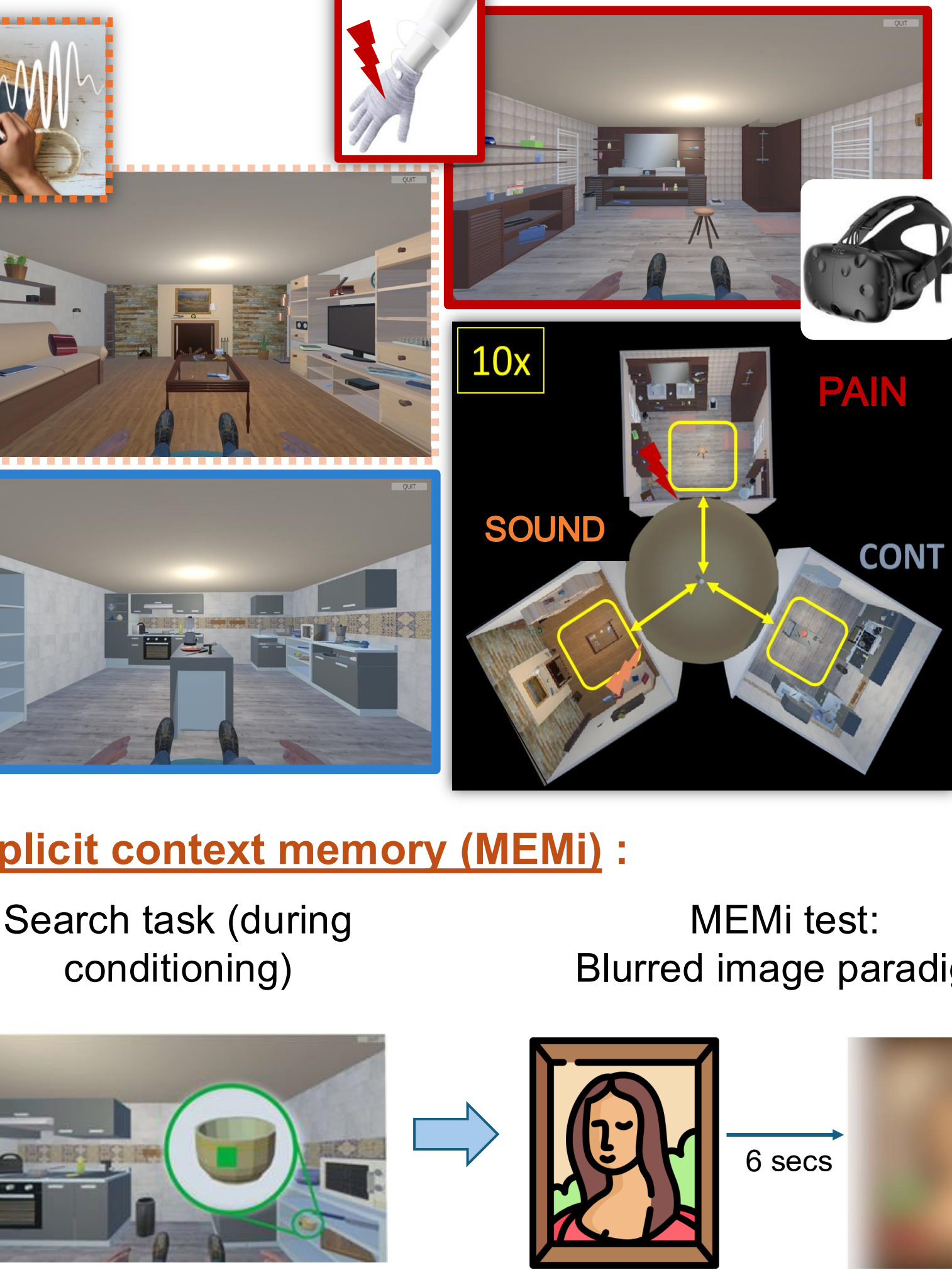
Pain/Sound evaluation (Visual analog scales, VAS)



Behavioural measurements at different time points:

- Pain:** Intensity and Unpleasantness → During and after conditioning, 1 day and 15 days later
- Sound:** Unpleasantness → After conditioning, 1 day and 15 days later
- Contextual environment:** Valence of each room → After familiarisation, after conditioning, 1 day and 15 days later
- Implicit context memory** → After conditioning, 1 day and 15 days later

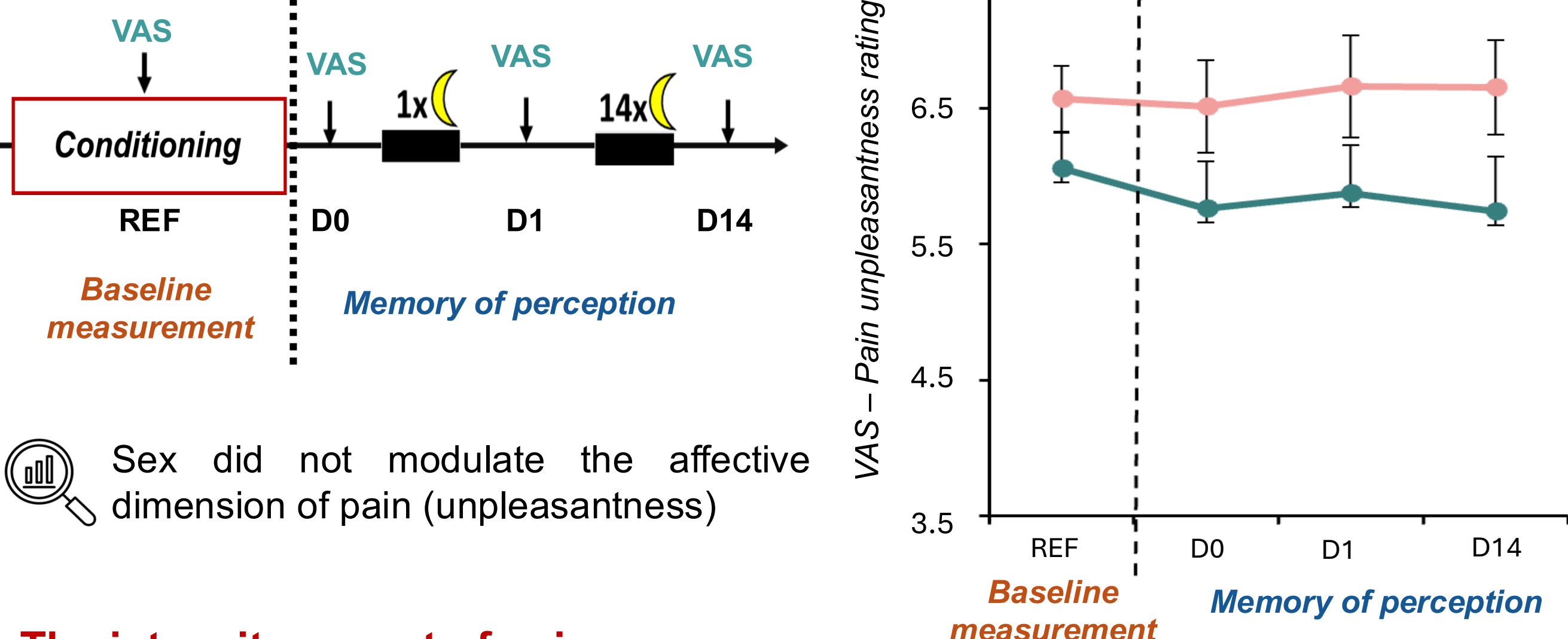
Implicit context memory (MEMi):



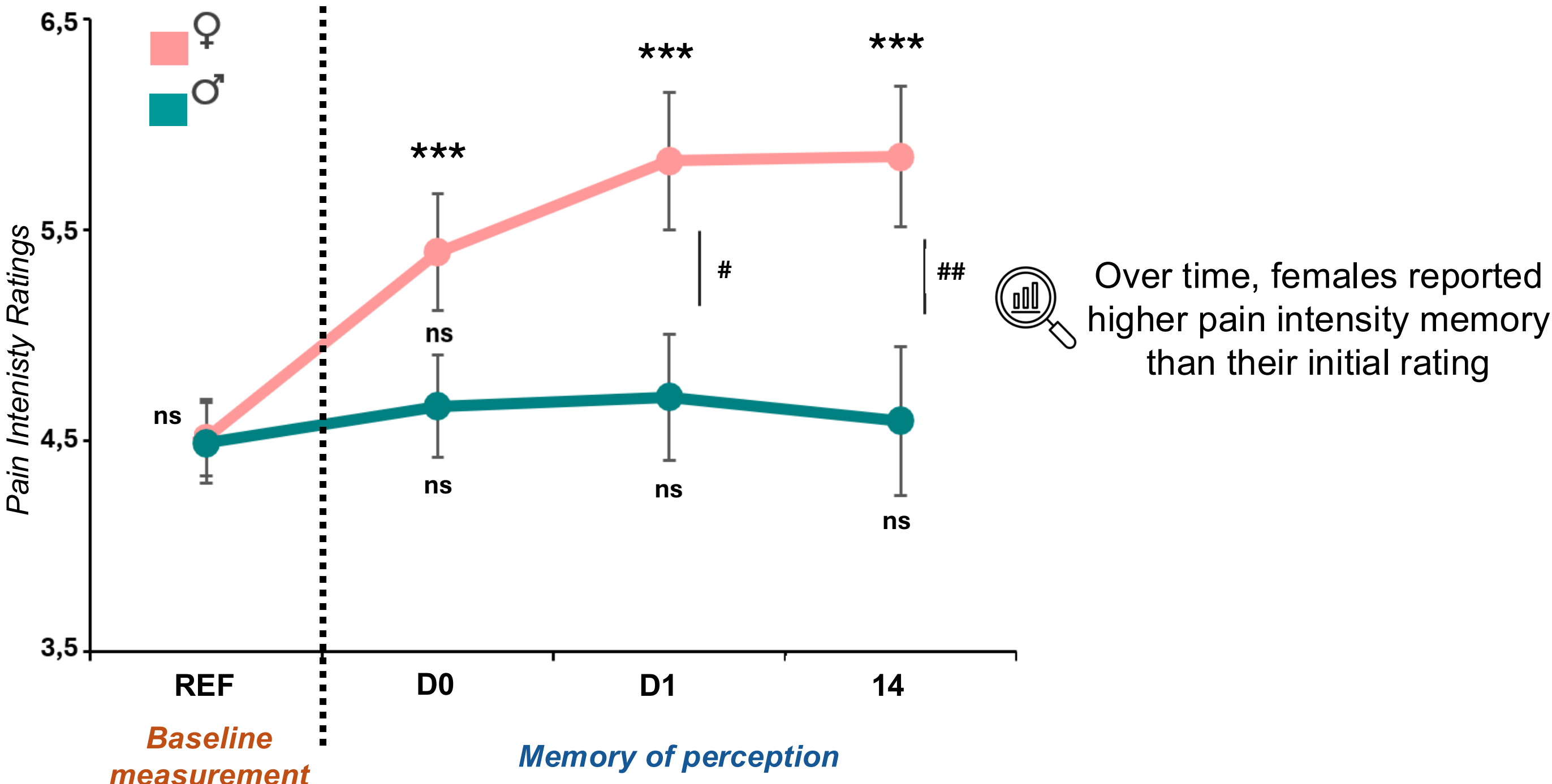
RESULTS

Comparison between objective ratings and perceptual memory (VAS)

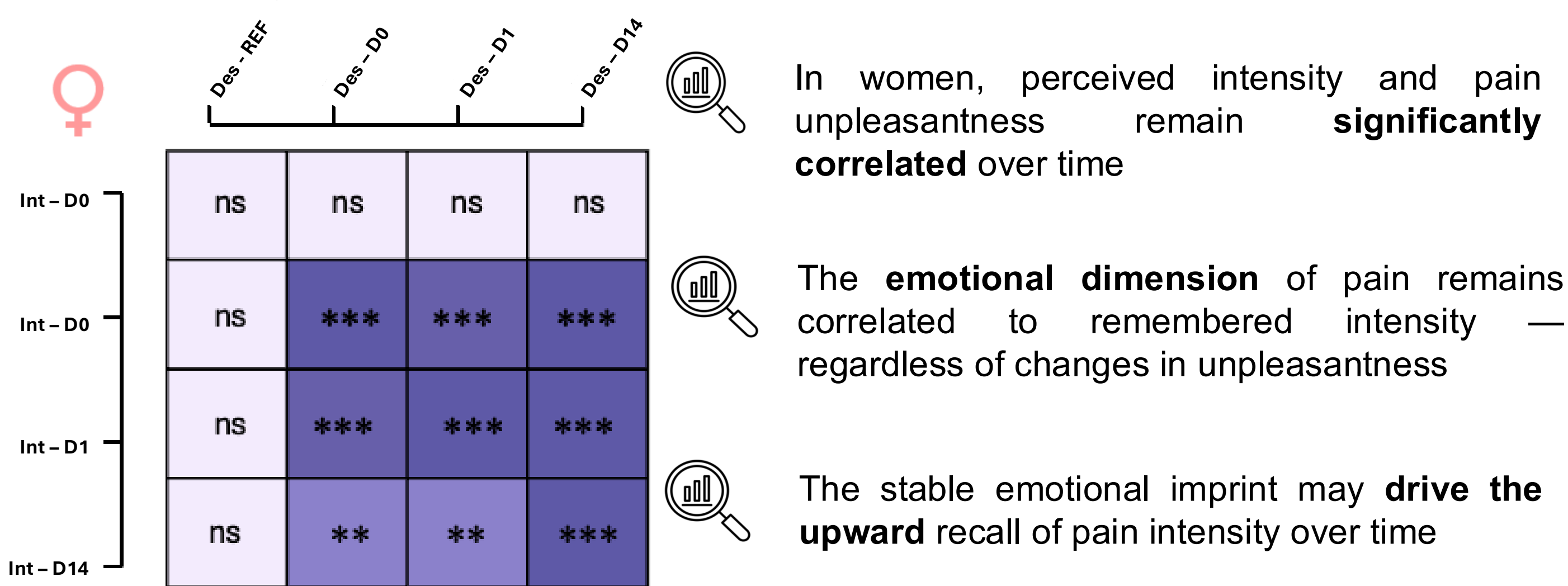
The unpleasant aspect of pain



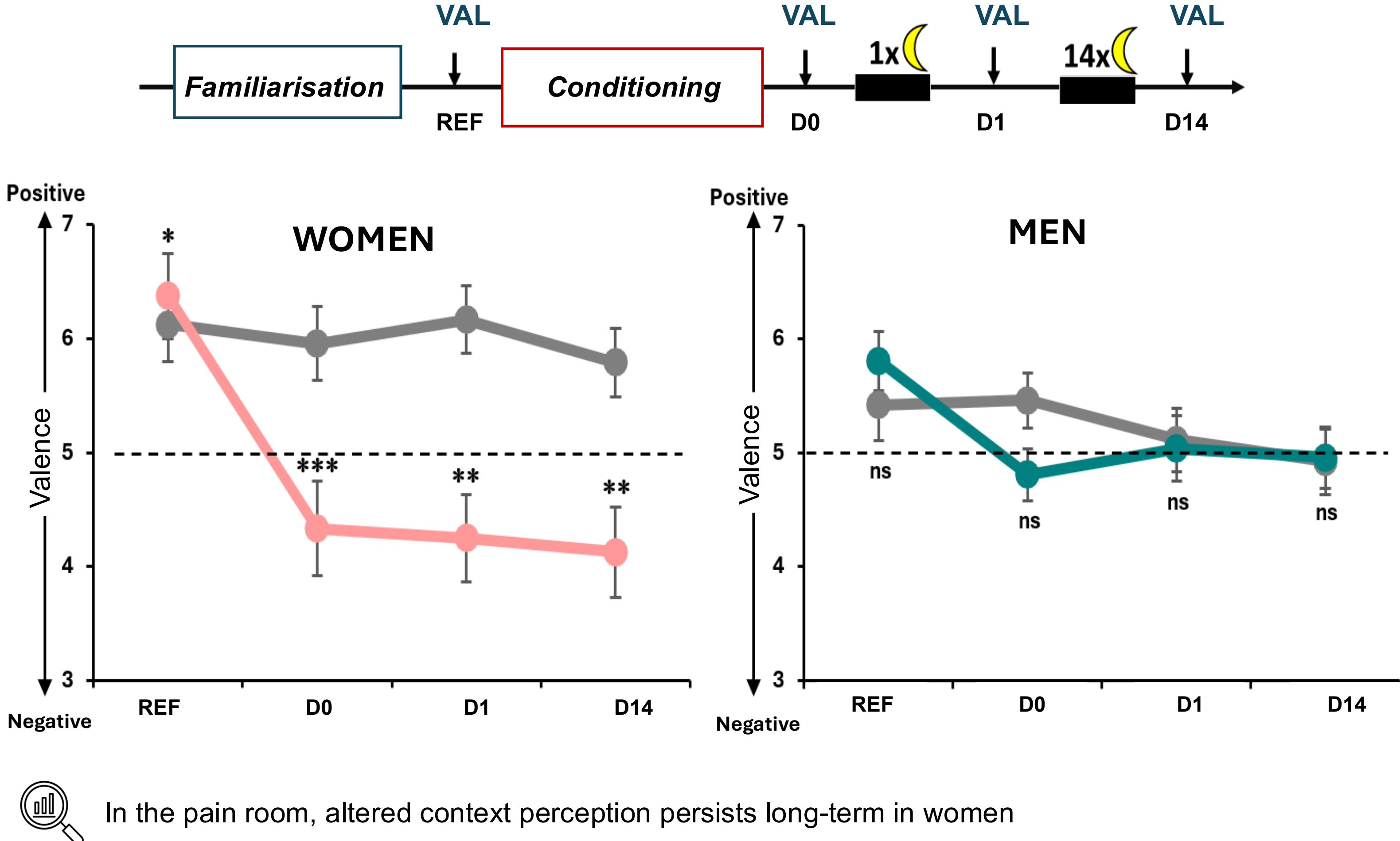
The intensity aspect of pain



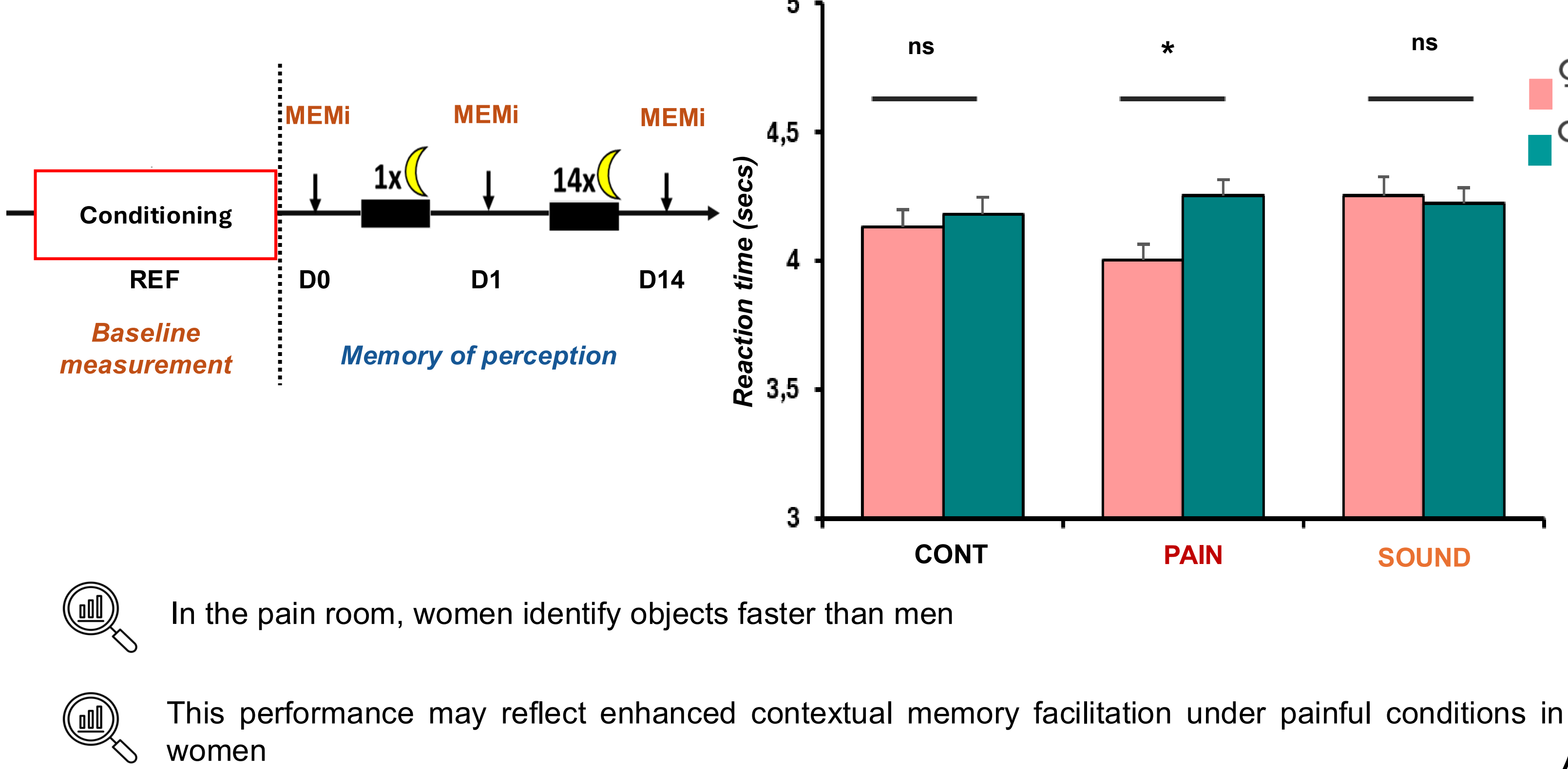
Intensity-Unpleasantness Relationships in Women



Perception of the contextual environment (VAL)



Implicit context memory (MEMi)



CONCLUSIONS

Aversive stimulations altered contextual perception in both women and men. In women only, however, pain led to a long-term memory distortion, marked by an amplified recall of previously experienced pain. This sex-specific effect suggests that the influence of contextual conditioning may be more persistent in women.

Such long-lasting alterations in pain memory could contribute to the development or maintenance of chronic pain, underlining the importance of considering sex differences in pain-related learning and memory processes.

CONTACT

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REFERENCES

- 1. Apkarian VA. et al. (2009), Neurobiology.
- 2. Van Meurs B. et al (2014), Behav Res Ther
- 3. Meulders A. et al (2023), J Pain