

The Rubber Hand Illusion: Does Load Affect EEG & Electrodermal Activity?



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INTRODUCTION

The **Rubber Hand Illusion (RHI)** induces distortions in body ownership through bottom-up multimodal sensory processing. However, recent research has demonstrated the modulatory effects of top-down manipulations within this paradigm. In the present study, we aimed to replicate the neural, electrodermal, and subjective correlates of the RHI and to explore the effects of cognitive load on these measures.

RESEARCH QUESTION

IS THE RUBBER HAND ILLUSION PERVIOUS TO A COGNITIVE LOAD MANIPULATION?

METHOD

SETUP

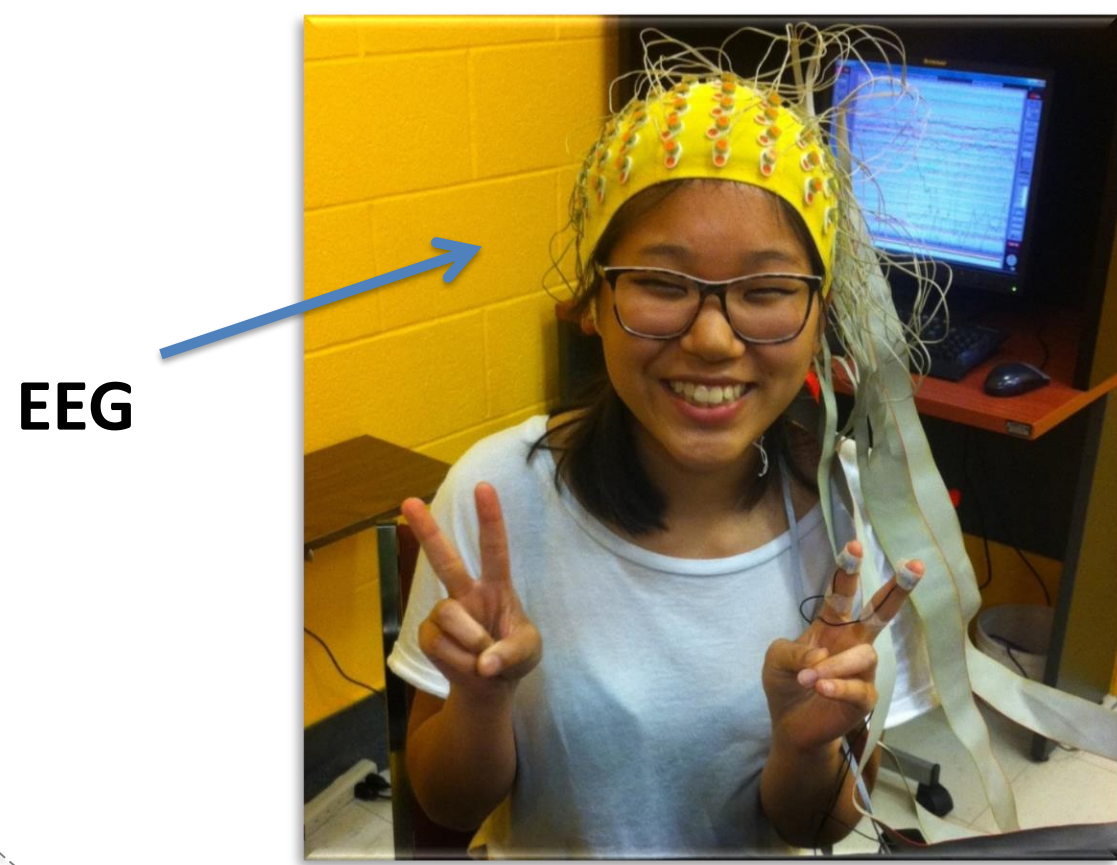
We assessed the neural correlates of the RHI using electroencephalography. We placed a life-like silicone arm on the right shoulder of participants, who were seated at a table with their right hand behind a visual occluder and their left hand visible on the table in front of them. We stroked participants' right hand and the fake hand either synchronously or asynchronously in three-minute trials.



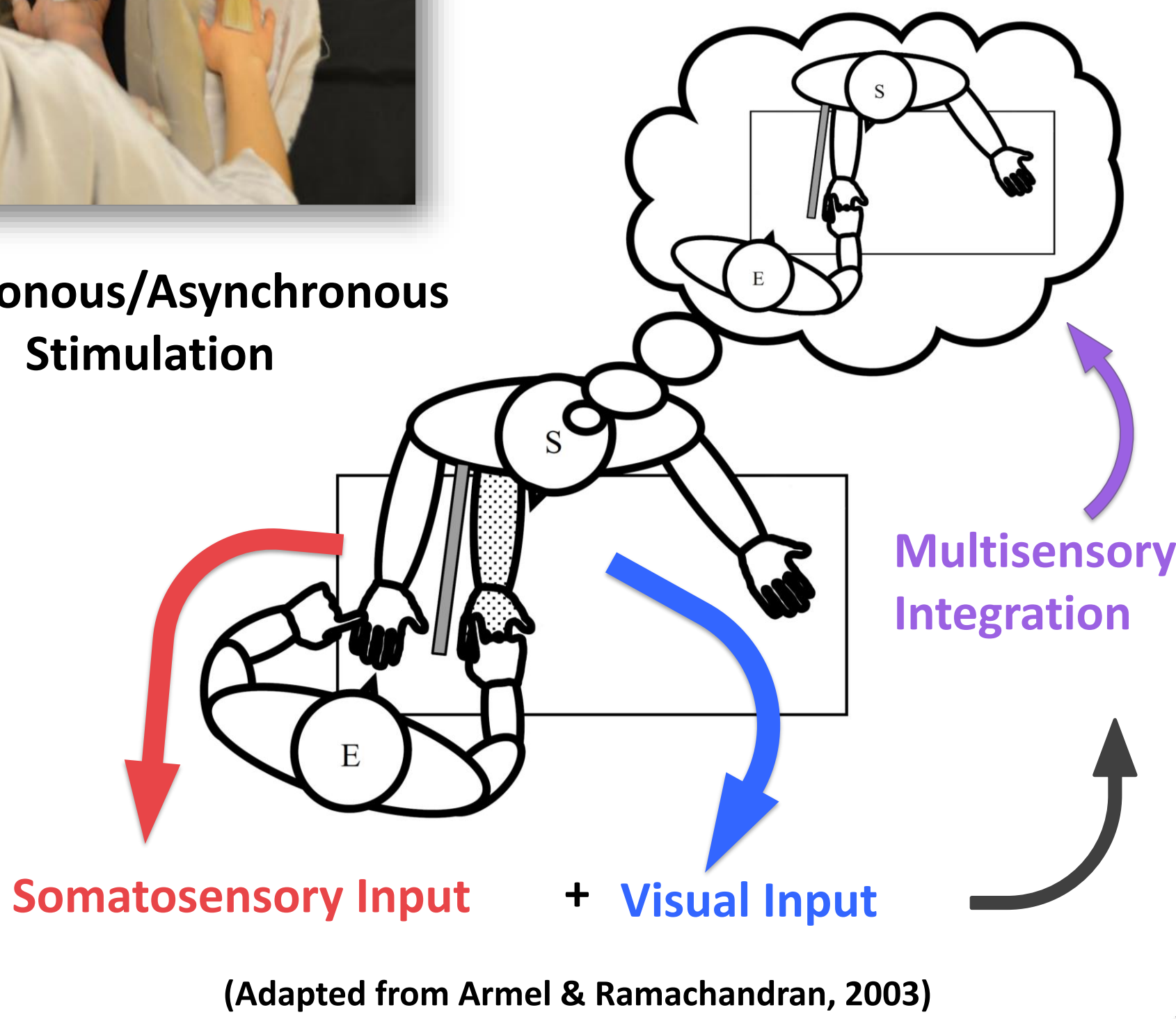
Real Hand
Fake Hand



Synchronous/Asynchronous
Stimulation



EEG

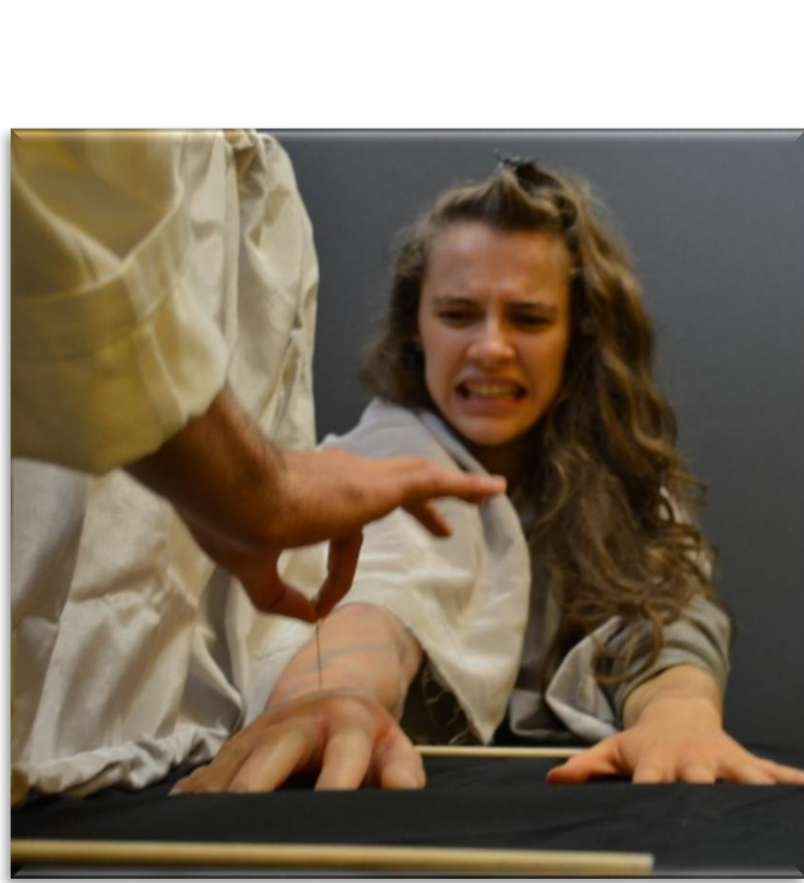


(Adapted from Armel & Ramachandran, 2003)

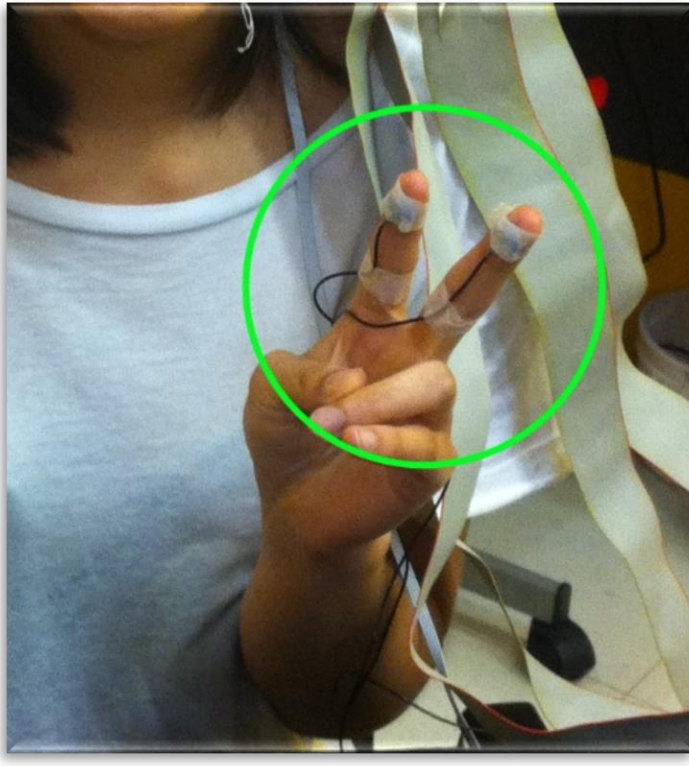
ILLUSION STRENGTH

During each trial, we threatened the rubber hand with a blunt needle six times throughout the last two minutes of the trial. Participants' physiological response (electrodermal activity) to the threat to the fake hand served as an objective measure of the strength of the illusion.

In addition, we assessed the subjective strength of the illusion using a validated body ownership questionnaire after each condition.



Threat



Electrodermal Response

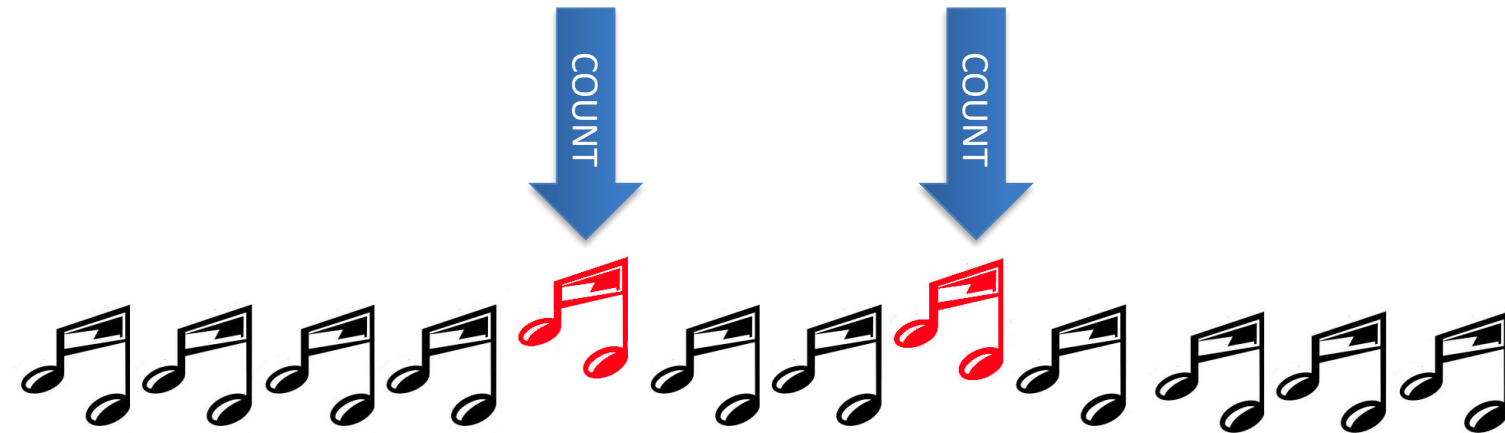
CONDITIONS

We tested our research question by crossing the effects of the RHI with a cognitive load task in a 2x2 counterbalanced within-subjects design with two antecedent baseline conditions.

	Synchronous Stroking	Asynchronous Stroking
	Baseline Synchronous	Baseline Asynchronous
Baseline		
No Load	No Load Synchronous	No load Asynchronous
Load	Load Synchronous	Load Asynchronous

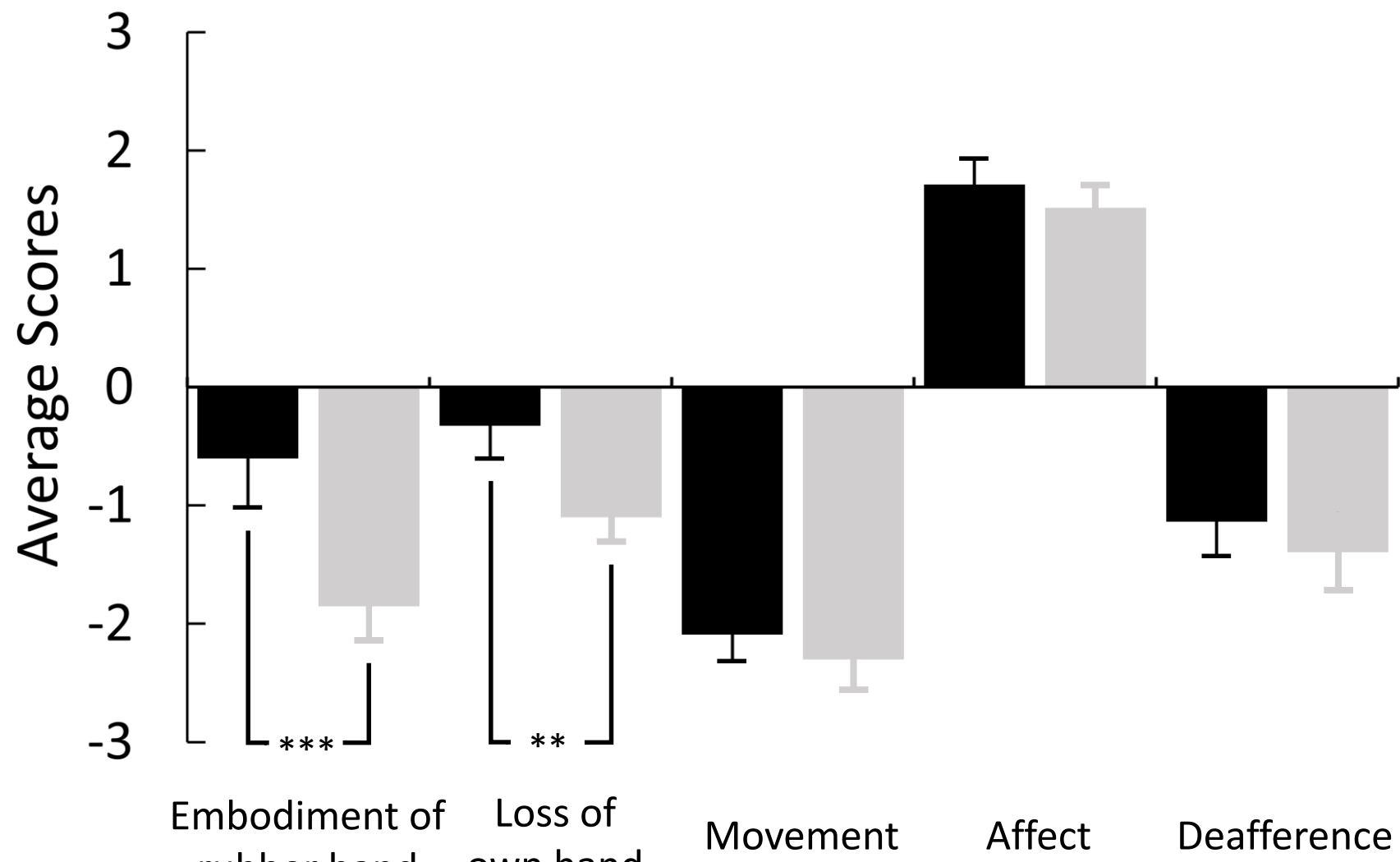
COGNITIVE LOAD

During the Load conditions, participants performed an auditory oddball task to induce cognitive load. During the No Load conditions, participants heard the audio tones but were instructed to ignore them.



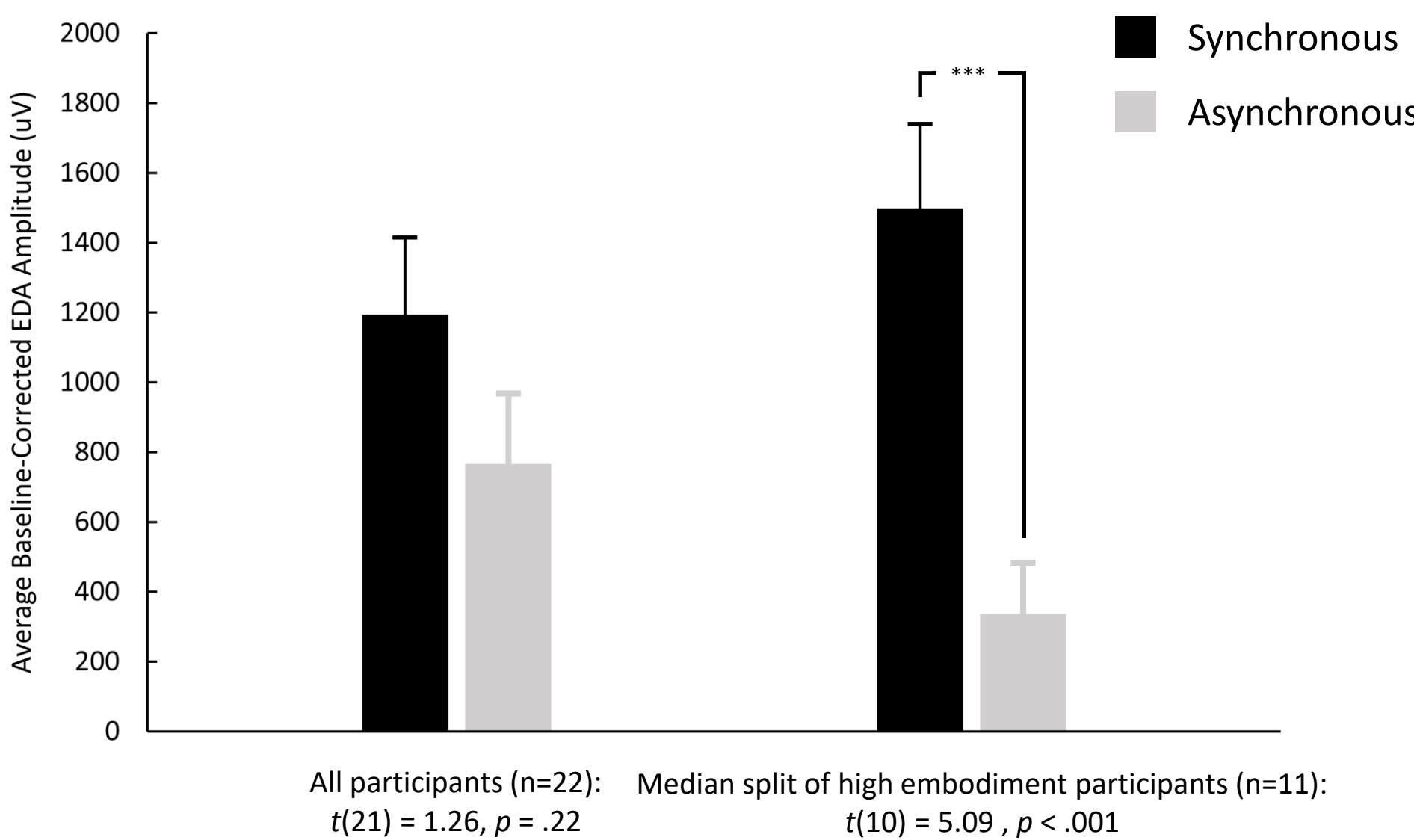
RESULTS

Subjective Reports

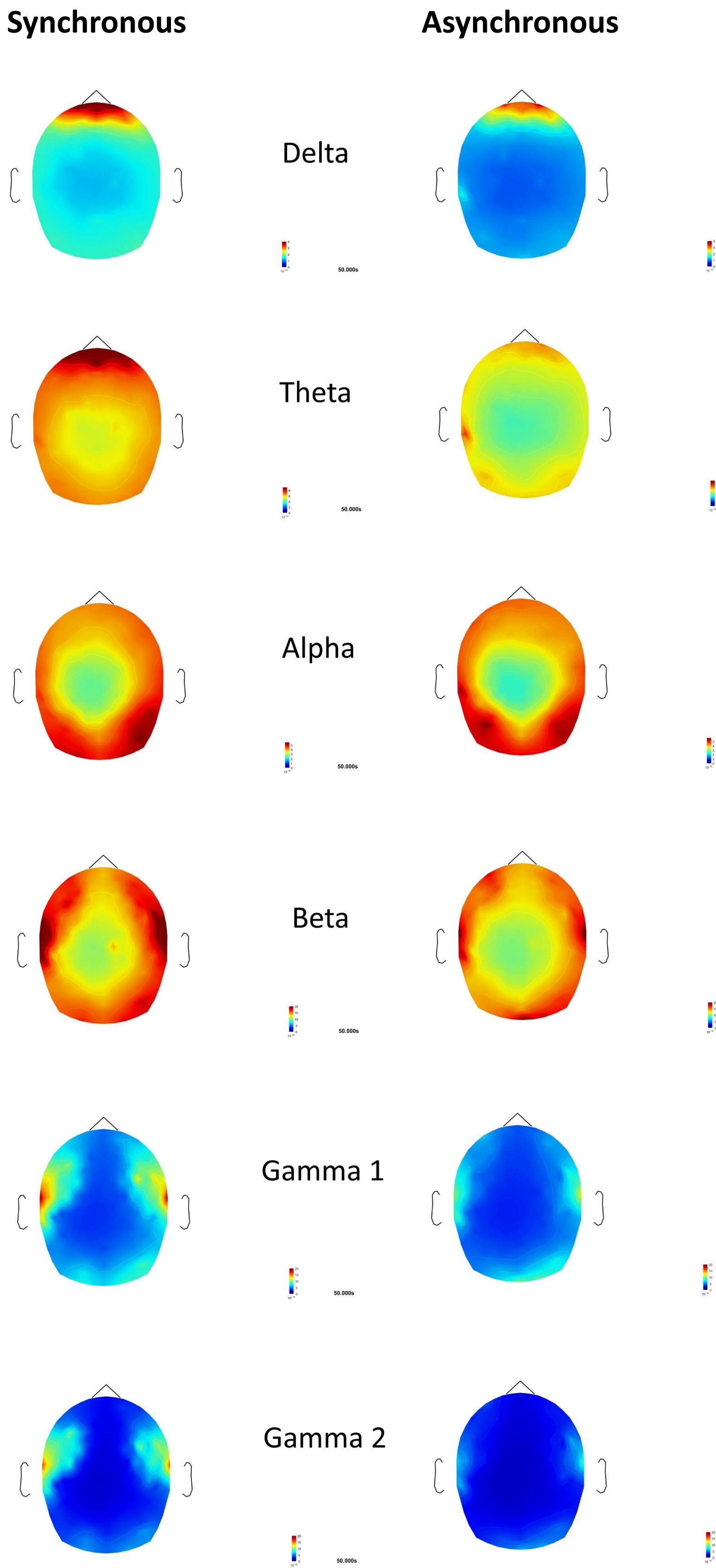


Embodiment: $t(21) = 4.047, p < .001$
Loss of Own Hand: $t(21) = 3.389, p < .01$

Electrodermal Activity Following the Threat



EEG Activity by Band Frequency After 50 Seconds of Stroking



Synchronous and asynchronous stroking did not lead to any significantly different pattern of band activity.

DISCUSSION

Our results replicate in part previous findings by showing that the RHI corresponds to changes in feelings of *Embodiment* and *Loss of own hand*. We show that electrodermal activity following a threat to a fake hand pertains to feelings of embodiment of that fake hand. Moreover, we show that the load manipulation affected the loss of own hand dimension whereby high load related to stronger feelings of losing one's own hand. Our results suggest that cognitive resources do influence the RHI, but moderately and specifically so. However, we were unable to replicate the neural correlates of the RHI.

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