

# Towards Congruent BCI Feedback

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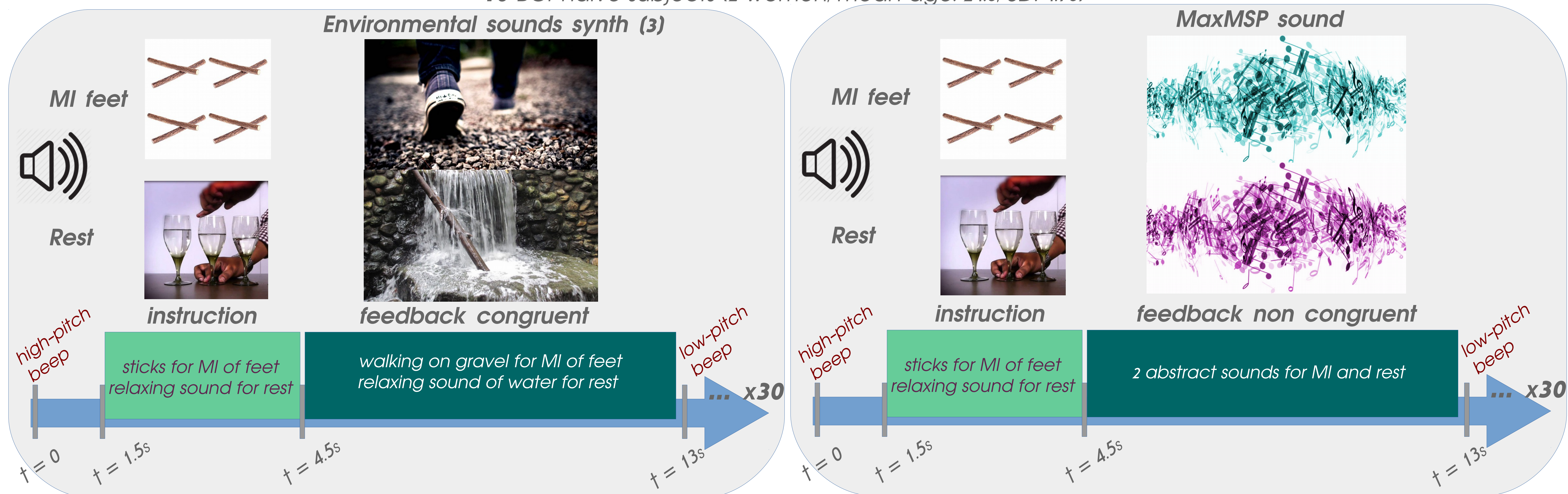
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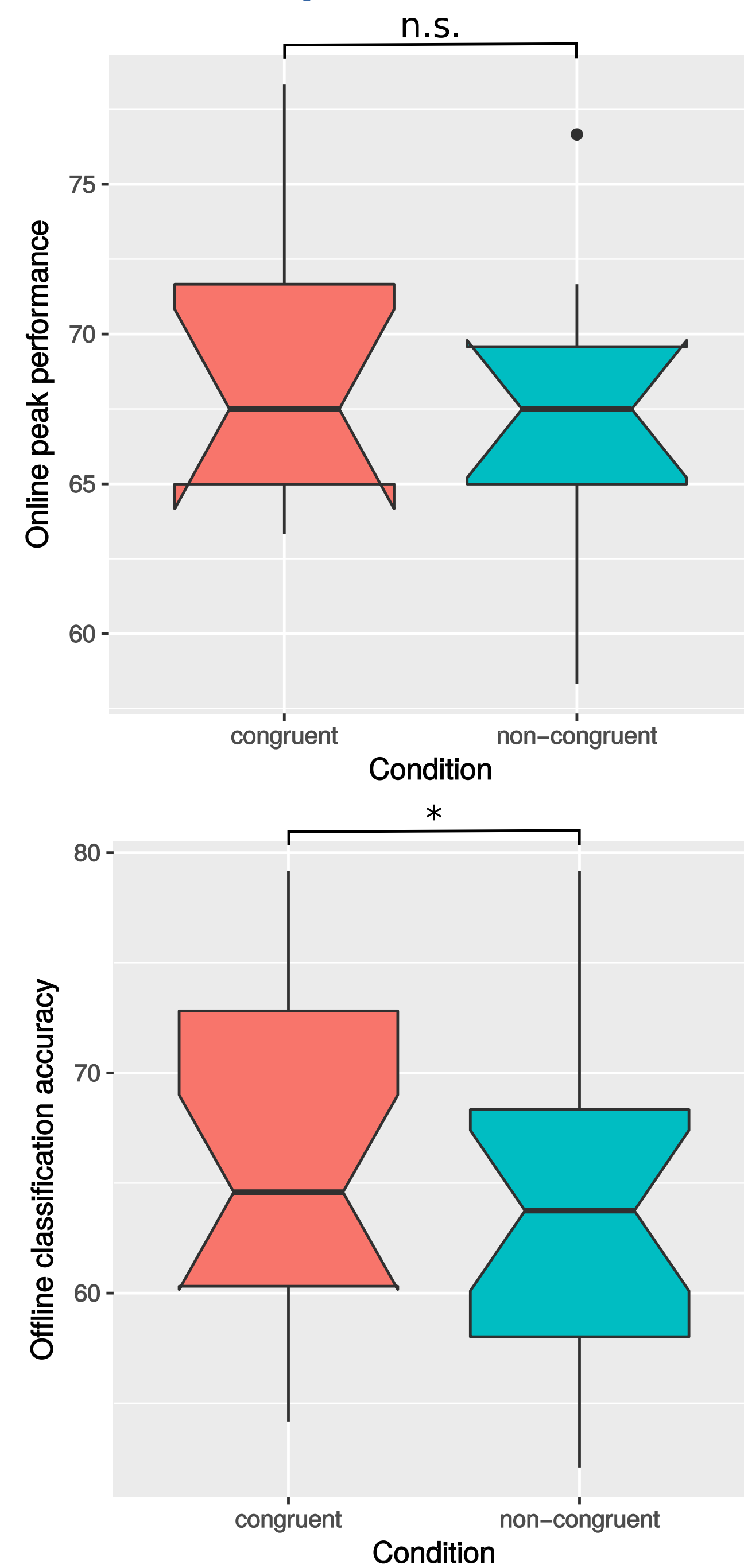
In our previous study (1), we have found that background (asynchronous) music can disrupt one's MI performance. Hence, we wished to test how sound which is synchronized to one's imagined movements and also related to the task (congruent) could assist in creating ERD/ERS patterns. Visual congruent MI feedback in VR showed to be more robust and give higher performances (2). However congruent feedback in auditory modality has not been explicitly explored yet. We present preliminary, but promising results of using congruent versus non congruent feedback for MI of feet.

## Experimental Design:

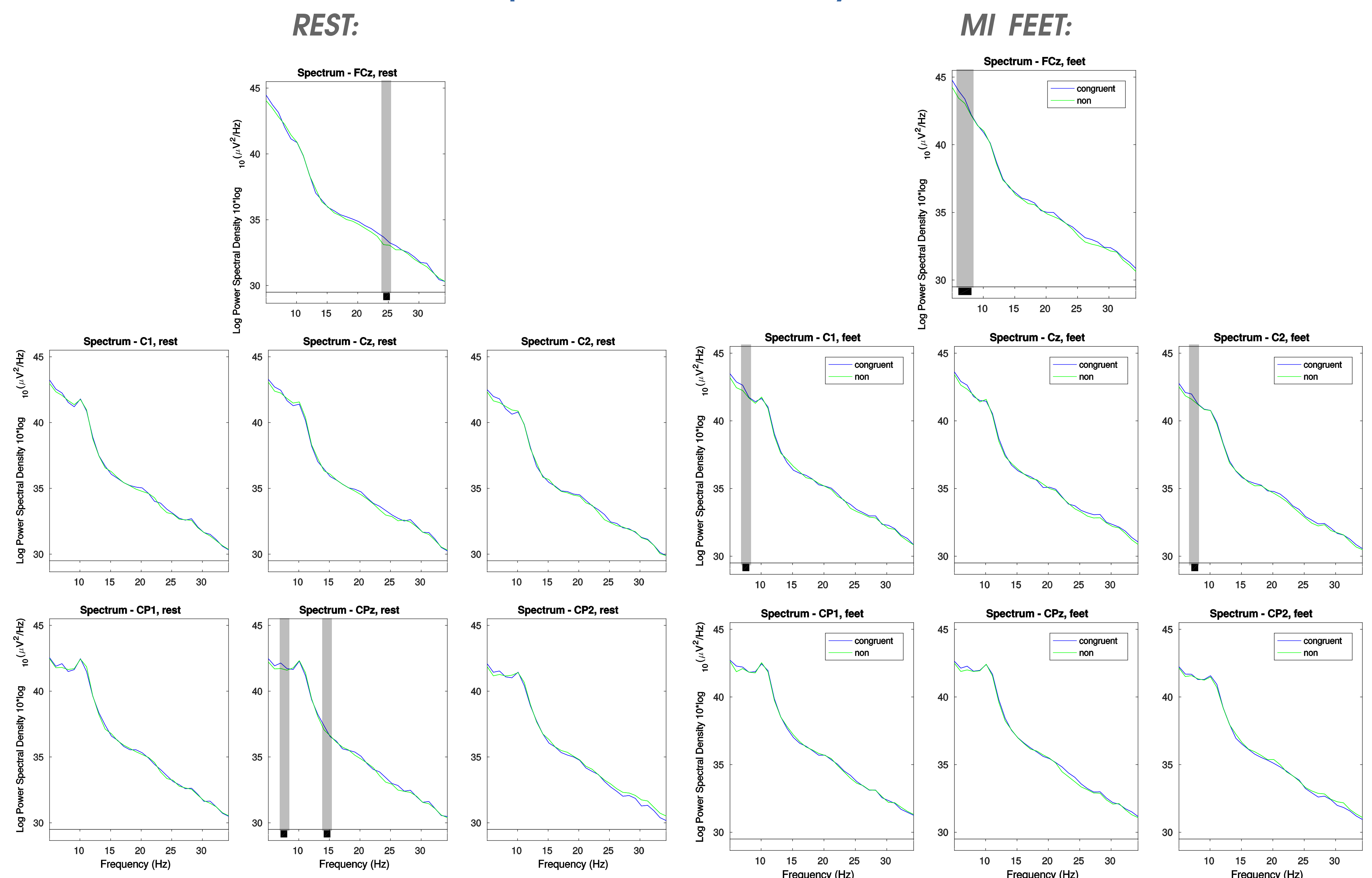
Within subject design (**congruent** vs **no-congruent**), counter-balanced order  
10 BCI-naïve subjects (2 women, mean age: 24.8, SD: 4.98)



## User performance



## Spectral analysis



Spectral power analysis per electrode. (significant differences are highlighted,  $p < 0.05$ ).

## RESULTS:

- Offline performance increased with a congruent feedback (classification accuracy: 66.1% (SD 7.45) vs 63.9% (SD: 7.8),  $p < 0.05$ )
- Congruent feedback led to higher power in beta band during rest, and higher power in alpha and beta during MI ( $p < 0.05$ )

## DISCUSSION:

- During post-hoc interviews, participant reported that they felt more assisted with a congruent feedback
- Pilot studies revealed that it was necessary to expose participants to the feedback prior to the experiments

We investigate the potential of an audio congruent task, tackling the sensory illusion of presence by providing realistic audio feedback using a synthesizer. We conducted an experiment to understand the influence of a congruent feedback on the performance and neurophysiology in a MI BCI task. While it did not influence online performance, a feedback congruent to the task led to higher offline classification accuracy and to a better user experience. In the future with such an online synthesizer we could not only generate congruent feedback but also create environmental sound for a more realistic experience.