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Impact of group synchrony, postural stability and agency on cybersickness symptoms

Julia Ayache, Camille Pistre, Pierre Jean, Anna Katharina Hebborn, Didier Stricker, Benoit Bardy

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BACKGROUND

More than 50% of users report cybersickness symptoms when they first immerse in Virtual Reality (VR) [1]. Therefore, despite technological advances, cybersickness remains a challenge impeding the adoption of VR.

The postural instability hypothesis suggests that cybersickness could result from postural instability [2]. Interestingly, postural stability is often studied in single individuals, while studies [3,4] reported an increase of postural stability when moving in synchrony with others.

→ Does group synchrony could increase postural stability and reduce cybersickness?

METHODS

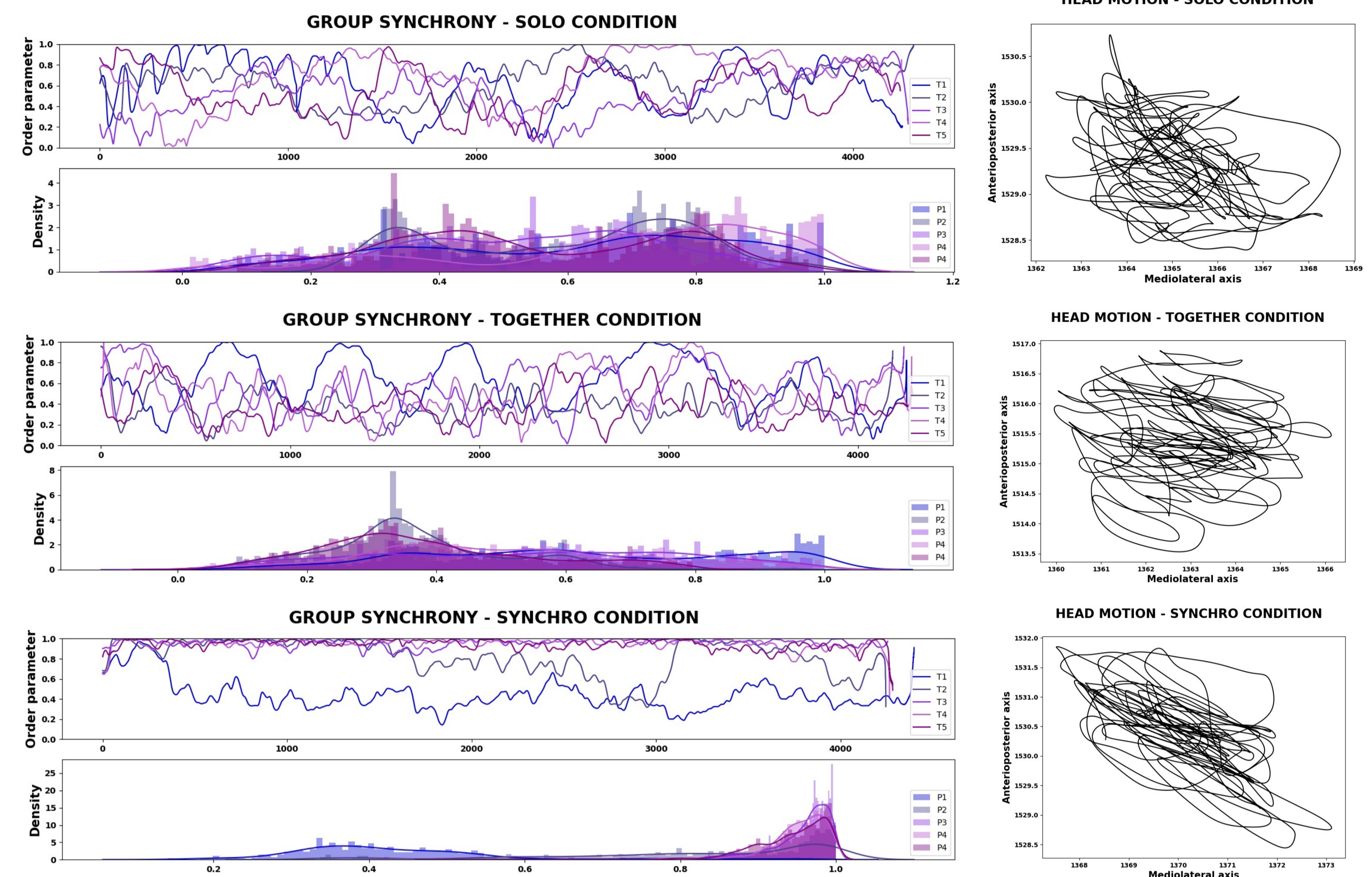
7 triads ($N = 21$) completed oscillatory movements with their right arm in VR under three conditions; manipulating visual coupling (SOLO) and synchronization instructions (TOGETHER and SYNCHRO).



Illustration of the virtual environment and avatar representations

- Group and individual synchrony scores were extracted using the Kuramoto model [5].
- Postural stability was computed from the normalized length of head motion on the anteroposterior and mediolateral directions [6].
- Cybersickness symptoms were measured before and after each condition with the Simulator Sickness Questionnaire (SSQ, [7]).
- Sense of agency (SoA) was measured after each VR immersion using the Sense of Agency Scale (SoA, [8]).

RESULTS



Graphical representations of the impact of the experimental conditions SOLO (top), TOGETHER (middle) and SYNCHRO (bottom) on group synchrony scores (left) and body sway (right)

Mixed models showed that the experimental conditions influenced:

- Group synchrony scores ($F(2, 96) = 107.36, p < .001$), with an increase of group synchrony when participants could see each other and were instructed to synchronize (SYNCHRO condition, adjusted $p < .001$).
- Postural stability ($F(2, 310) = 3.28, p = .039$), with a decrease of body sway in the SYNCHRO condition (adjusted $p = .055$).

However, there was no effect of the experimental manipulation on cybersickness symptoms ($F(2, 58) = 0.17, p = .847$) and sense of agency ($F(2, 58) = 0.71, p = .494$) but a tendency for a negative correlation between cybersickness symptoms and sense of agency ($r = -.21, p = 0.09$).

DISCUSSION

This study demonstrated (i) the role of visual coupling and instructions to synchronize in VR [5], (ii) the impact of group synchrony on postural stability beyond dyads [3,4].

While there was no impact of synchrony nor body sway on cybersickness, this study reports a possible association of agency with cybersickness.

- This finding paves the way for exploring the role of temporal binding between actions and their consequences on cybersickness in social VR.

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