

## Virtual reality questionnaires

Given the task is performed through an VR-HMD device, the inquiry into the sense of authorship over one's own movements is important in understanding the extent to which participants engage in the task. This dimension was assessed by the F-SOAS scale (Tapal et al., 2017, Hurault et al., 2020) which is divided into 2 factors which can be treated separately: Sense of Positive Agency (SoPA) rated from 6 to 42 and Sense of Negative Agency (SoNA) rated from 7 to 49. We asked participants to complete the scale in reference to the adaptation cycle which is a critical moment for the agency. SoPA (adaptation group: mean = 27.8, SD = 7.4; washout group: mean = 27.7, SD = 7.2) and SoNA (adaptation group: mean = 23.8, SD = 7.2; washout group: mean = 23.2, SD = 6.8) both reached an intermediate score, nevertheless SoPA being higher than SoNA. This result shows that participants, on average, have a moderate sense of agency ensuring that they felt authorship over their own movements.

Following Spearman's correlations were calculated with a two-tailed hypothesis test. Angle final steady-state ( $a$  from Eq. 1) was correlated with the expertise index in adaptation cycle (Spearman's  $\rho(26) = 0.437$ ,  $p = 0.02$ ) but not in the washout cycle (Spearman's  $\rho(29) = -0.278$ ,  $p = 0.13$ ). Length time constant ( $c$  from Eq. 1) was correlated to SoPA (Spearman's  $\rho(29) = -0.405$ ,  $p = 0.024$ ) and SoNA (Spearman's  $\rho(29) = 0.366$ ,  $p = 0.043$ ) in washout cycle but neither in the adaptation one (SoPA Spearman's  $\rho(26) = -0.001$ ,  $p = 0.998$ ; SoNA Spearman's  $\rho(26) = 0.169$ ,  $p = 0.391$ ). The  $R^2$  exponential fit with the angle data in the adaptation cycle shows a correlation with the angle final steady-state in the adaptation cycle (Spearman's  $\rho(26) = 0.697$ ,  $p < 0.001$ ). The  $R^2$  exponential fit with the length data in the adaptation cycle shows a correlation with the expertise index (Spearman's  $\rho(26) = -0.456$ ,  $p = 0.015$ ) and with the length final steady-state in the adaptation cycle (Spearman's  $\rho(26) = -0.429$ ,  $p = 0.024$ ). The  $R^2$  exponential fit with the length data in the washout cycle shows a

correlation with the length final steady-state in the washout cycle (Spearman's  $\rho(29) = -0.431$ ,  $p = 0.016$ ).

The use of HMD-VR raises possible cybersickness issues which we have controlled with the SSQ-FR scale (Kennedy et al., 1993; Bouchard et al., 2011). The scale distinguishes nauseas (rated from 0 to 27) from oculomotor factors (rated from 0 to 21). Nauseas (adaptation group: mean = 1.5, SD = 1.6; washout group: mean = 1.6, SD = 1.5) and oculomotor factor (adaptation group: mean = 4.2, SD = 2.6; washout group: mean = 4.2, SD = 2.8) showed a low total cybersickness score (adaptation group: mean = 5.6, SD = 3.8; washout group: mean = 5.8, SD = 3.9). This shows that the participants tolerated well the VR experiment. Considering the limited score range, cybersickness appears negatively correlated with SoPA (adaptation group: Spearman's  $\rho(26) = -0.451$ ,  $p = 0.016$ ; washout group: Spearman's  $\rho(29) = -0.392$ ,  $p = 0.029$ ) and positively correlated with SoNA (adaptation group: Spearman's  $\rho(26) = 0.389$ ,  $p = 0.041$ ; washout group: Spearman's  $\rho(29) = 0.420$ ,  $p = 0.019$ ).

## References

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