28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Anticipation performance in virtual reality boxing: impact of gaze-contingent blur on elite boxers.

LIMBALLE, A., KULPA, R., VERHULST, E., LEDOUIT, S., BENNETT, S.

Univ Rennes, Inria, M2S - EA 7470, Rennes, France

INTRODUCTION:
Perceptual-motor skills are essential to performance in combat sports but remain poorly trained (Romeas et al., 2022), often with a focus on reaction time. Therefore, we studied how the properties of VR (standardization, reproducibility, and perception-action coupling) can facilitate the development of new tools that assess perceptual-motor skills underlying performance. Particularly, we are interested in the impact of a visual blur on anticipation in boxing. The introduction of blur inhibits visual perception of fine details that can act as distractors but preserves essential information such as the kinematics of the opponents limbs. To date, blur has been applied in real word settings using lenses (Mann et al. 2010) or 2D computer blurred displays (Ryu et al. 2015). Using 2D video display and gaze-contingent blur, Ryu et al. reported that novices, but not experts, decision making benefited when a moderate level of blur was applied in peripheral vision. However, these studies did not manipulate the location of blur in a realistic 3D visual task, where normal perception-action coupling was preserved.

METHODS:
To overcome these limitations, we used a gaze-contingent gaussian blur within a VR environment. 11 French elite athletes faced a virtual opponent, standing 1 m away in a virtual ring, who launched successive attacks of 20 sequences (10 of 1 punch and 10 of 2 punches). Each participant completed 3 blocks of 60 trials, in a random-blocked order separated by a 2-minute break. In each block, participants performed the task in one of 3 Viewing Conditions. In the control condition, participants were presented with normal vision of the visual display. For the other 2 Viewing Conditions, a gaze-contingent blur manipulation was made relative to the point of fixation, such that participants were presented with a peripheral or a central blur. Participants had to avoid by dodging the incoming punches and counterattack to touch the opponent.

RESULTS:
Linear mixed modelling revealed no significant effect of blur on performance but a significant main effect of the sequence type ($p<.0001$). Post-Hoc indicated that performance was better when facing sequences of one punch compared to sequences of two punches ($p<.0001$). The rating mean probabilities revealed that the number of dodges and counterattacks was similar when facing one punch sequences, but the number of counterattacks decreased more when facing a two punch sequences (0.144) compared to dodging response (0.198).

CONCLUSION:
Overall, the results showed expert boxers were resilient to blur in this VR anticipation task. Interestingly, however, observation of the individual response data showed individual variability depending on the blur condition. It is envisaged that this new method will enable more consideration of the how blur can be used in the investigation of perceptual-motor learning.

This work is part of REVEA and DIGISPORT projects supported by the ANR in the “France 2030” program (20-STHP-0004 and ANR-18-EURE-0022).

Topic: Sport Technology

Presentation Oral