

Tracking expertise in visual information pickup when throwing basketball using virtual reality

Antoine H.P. Morice, Pooya Soltani

► **To cite this version:**

Antoine H.P. Morice, Pooya Soltani. Tracking expertise in visual information pickup when throwing basketball using virtual reality. 19ème Congrès International de l'ACAPS, Oct 2021, Montpellier, France. hal-03409571

HAL Id: hal-03409571

<https://hal-amu.archives-ouvertes.fr/hal-03409571>

Submitted on 29 Oct 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Tracking expertise in visual information pickup when throwing basketball using virtual reality

Antoine Morice ^{*† 1}, Pooya Soltani ^{* ‡ 3,2}

¹ Aix-Marseille Université, CNRS, Institut des Sciences du Mouvement UMR 7287, 13288, Marseille, France (ISM) – Aix-Marseille Université - AMU – France

³ Centre for the Analysis of Motion, Entertainment Research and Applications (CAMERA), Department of Computer Science, Department of Health, University of Bath, Claverton Down, Bath BA2 7AY – United Kingdom

² Aix-Marseille Université, CNRS, Institut des Sciences du Mouvement UMR 7287, 13288, Marseille, France – Aix-Marseille Université - AMU – France

Introduction

The basketball court offers multiple sources of visual information for players to perceive the basket's distance. *Elevation angle* of the basket in the field of view would be of larger importance than *stereoscopy* and *motion parallax* (de Oliveira et al., 2009). Other sources of visual information should be considered to complete the picture such as the ratio between the optical height and width of the basket (i.e., *form-ratio*). The perceptual superiority of experts over novices in picking up those information sources for regulating their throw should be established.

Method

Ten experienced and thirteen novice basketball players threw naturally a basketball in a realistic simulator. Ball trajectory was captured by two CX1 Codamotion Units and extrapolated online to render onto a large stereoscopic screen its landing on a basket embedded in a virtual gymnasium. The perception of the virtual basket's distance with respect to free-throw was manipulated by independently decorrelating from the actual throwing distance *form-ratio*, *stereoscopy*, *motion parallax*, and *elevation angle* while keeping the other sources of information specifying the basket's distance unchanged. We tracked changes in ball trajectory in response to the modified source of information.

Results

When decorrelating *form-ratio* and *stereoscopy*, induced perception of a near basket resulted in a shorter ball trajectory while far basket perception resulted in a longer trajectory. Decorrelation of the *Form-ratio* induced larger changes in ball trajectory than decorrelation of the *stereoscopy*, especially for the far basket. Novices responded less to decorrelation of *form-ratio* than experienced players. Novice responded more to decorrelation of *stereoscopy* than experienced players.

*Speaker

†Corresponding author: antoine.morice@univ-amu.fr

‡Corresponding author: ps2193@bath.ac.uk

When decorrelating *motion parallax* and *elevation angle*, ball trajectory suggested that both novices and experienced did not perceive a near or far but rather an elevated or lowered basket. Overall, the influence of *Elevation angle* was stronger than those of *Motion Parallax*. Changes in trajectories were stronger for novice than for experienced players.

Discussion & Conclusions

Large changes in ball trajectory in the direction of a biased perception of basket's distance resulted from the decorrelation of Form-ratio. *Form-ratio* would therefore be as important for basketball players as it is for airplane pilots who use it to perceive the distance from a runway to land (Galanis et al., 1998). Smaller changes in trajectory induced by the decorrelation of *Stereoscopy*, especially for the far basket, are consistent with the usefulness of *Stereoscopy* for longer distances. Unexpected changes in trajectory when decorrelating *motion parallax* and *elevation angle* contradict de Oliveira's results (2009) and suggest that experienced would be greater calibrated to the basket height than novice players. Basketball throwing performance can thus be examined with virtual reality without impoverishing the visual scene and without equipping basketball players with bulky eye-tracking systems.

References

- de Oliveira, R. F., Oudejans, R. R. D., & Beek, P. J. (2009). Experts appear to use angle of elevation information in basketball shooting. *Journal of Experimental Psychology: Human Perception and Performance*, *35*(3), 750–761
- Galanis, G., Jennings, A., & Beckett, P. (1998). A Mathematical Model of Glide-Slope Perception in the Visual Approach to Landing. *The International Journal of Aviation Psychology*, *8*(2), 83–101

Keywords: Depth perception, Optical information, Expertise, Basketball throwing, Virtual reality