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Comparison of Multiple Object Tracking Performance Between Professional and Amateur eSport Players as Well as Traditional Sportsmen

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ABSTRACT

High performance in multiple object tracking paradigms is associated with well-trained visuo-spatial abilities, visual memory, and divided attention. These abilities are essential for both traditional sport and eSport. The present study compared the tracking performance of professional as well as amateur eSport players and traditional sportsmen. Professional eSport players outperformed amateurs, while no other group differences were found. Positive association of eSport playtime and tracking performance as well as elevated tracking scores of the entire study cohort compared to normal population indicate a connection of eSport and sport activity and tracking performance.

KEYWORDS

eSport, Gaming, Perceptual-Cognitive Abilities, Performance, Playtime, Professional Players, Visual Tracking

INTRODUCTION

Electronic Sport (esport) is a widespread and increasingly growing economic, cultural, and scientific phenomenon. With an audience up to 495 million (Newzoo, 2020) and an expanding player base of both casual and professional players, the competition for immense prize pools on the top level is getting more and more intense. The competition in esports takes place on different levels. Amateurs on the lowest level compete in tournaments for fun and without any monetary motivation, while professional players earn a relevant amount of income by playing, either alone or in teams. The main distinction between amateurs and professionals in esport is not clearly or officially defined, mostly it is based on the presence of relevant income (Lipovaya et al., 2018) earned by competition in tournaments. This classification is applied identically in many traditional sports, such as soccer or tennis, where players are defined as professionals if they are above a certain income limit or play in a certain

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division. The practice of sport (or esport) of professionals is therefore their profession. The current route to excellence in esport is still unclear (Pedraza-Ramirez et al., 2020), there are no developmental stages defined and no real career plans are established (Abbot & Collins, 2004). Currently only some thousand players can be accounted as professional in the esport context (Nielsen & Karhulahti 2017). Players compete in diverse fields including, real time strategy games, e.g., *StarCraft II* (Blizzard Entertainment, 2010). or *Age of Empires III* (Ensemble Studious, 2005), multiplayer online battle arena games, e.g., *Defence of the Ancients 2* (Valve Corporation, 2013) or *League of Legends* (Riot Games, 2009) or first-person shooters, e.g., *Call of Duty: Modern Warfare* (Infinity Ward, 2019) or *Counter-Strike: Global Offensive* (Valve Corporation, 2012). Other competitive games and simulations are based on traditional sports such as soccer, e.g., *FIFA 19* = Fédération Internationale de Football Association (EA Vancouver, 2018) or *PES 20* = Pro Evolution Soccer (PES Productions, 2019) or racing, e.g., *Gran Turismo Sport* (Polyphony Digital, 2017) or *Forza Motorsport 4* (Turn 10 Studios, 2011) (Bányai et al., 2019; Taylor, 2011).

All kinds of esport games require the player to react as fast as possible to versatile, primarily visual stimuli, to make quick as well as correct decisions in complex situations, and to inhibit unnecessary information along the way (Kowal et al., 2018). This is in line with the thoughts of Happonen and Minashkina (2019) as well as Himmelstein et al. (2017), who propose that quick decision-making, along with other mental factors, might be important to achieve victory. Accurate perception and tracking of movement are fundamental. For instance, players need to track their own moving avatar in League of Legends while simultaneously paying attention to the changing positions of multiple enemies and allies. Another example is the football simulation FIFA. Similar to real-world football, players need to keep focus on the ball-carrying avatar, opponents, and possible support avatars of their own team. This is particularly difficult, because all of these related possible focus points are in motion. This puts high demands on perceptual processing and central and peripheral attentional skills (Bavelier et al., 2011; Torner et al., 2019).

An essential ability to succeed in those situations has been given the name "multiple object tracking" (MOT) in the literature. MOT has been the subject of research for more than 30 years, first addressed by Pylyshyn and Storm (1988). Subjects in their experiment were able to track up to 4-5 moving objects in a confined space, bouncing off each other and the borders. The authors deduced that participants could not only use eye movements to follow the objects, but also an attentional locus that is independent of those movements. As a result of this finding, several models (grouping, attention switching, multifocal attention, preattentive indexes and object files) were proposed in order to explain the mechanisms of MOT in humans. Cavanagh & Alvarez (2005) as well as Oksama & Hyönä (2004) described these models in detail: The grouping and switching approaches only require a single focus of attention. The moving objects are grouped into a higher order object and the participant can then track the changing shape and handle the task with only one attentional channel. Additionally, when targets share common motion (e.g. move in the same direction), they group more strongly and tracking becomes easier. Switching required the participants to cycle through the targets and keeping track of all positions and anticipated locations. The multifocal attentional approach assumes that each target requires an independent focus of attention and this focus needs to be held until the movement of objects stops. The preattentive indexes model is somewhat similar to the multifocal model, it differs in the view that there is no explicit attentional focus needed to follow an object. The object files model is not an alternative model to e.g. multifocal attention, instead it describes in more detail which constituent processes are required to accumulate information about each moving object.

Summing up, MOT addresses the question, how well participants can perform in visuo-spatial, visual memory, multifocal and divided attentional tasks. Those tasks are all crucial for esport- as well as traditional sport performance.