Esports as a Driving Problem in Computer Graphics

Benjamin Watson
NC State University
Raleigh, North Carolina, USA
bwatson@ncsu.edu

Josef Spjut
NVIDIA
Durham, North Carolina, USA
jspjut@nvidia.com

Caitlin McGee
1HP
Washington, DC, USA
caitlinmcgeept@1-hp.org

Amine Issa
Mobalytics
Los Angeles, California, USA
uthgar@mobalyticshq.com

Wayne Mackey
Statespace
New York, New York, USA
wayne@statespacelabs.com

ABSTRACT

Esports is a growing worldwide phenomenon now rivaling traditional sports, with a deep dependence on real-time graphics technology. Despite this, the SIGGRAPH research community has largely ignored it. This panel brings together esports experts in engineering, medicine as well as cognitive and data science to argue that this must change. Like film, esports is an important problem for computer graphics, and could give rise to technologies and techniques benefitting not only esports, but society more broadly. With a series of moderated and audience questions, this panel will sketch the research challenges and potential benefits of esports, while also considering its risks.

CCS CONCEPTS

• **Applied computing** → **Computer games**; • **Human-centered computing** → *User studies*; • **Computing methodologies** → *Graphics systems and interfaces.*

KEYWORDS

esports, human performance, real-time display, low-latency interaction

ACM Reference Format:
Benjamin Watson, Josef Spjut, Caitlin McGee, Amine Issa, and Wayne Mackey. 2021. Esports as a Driving Problem in Computer Graphics. In *Special Interest Group on Computer Graphics and Interactive Techniques Conference (SIGGRAPH '21 Panels), August 09-13, 2021.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3450617.3464499

1 WHY RESEARCH ESPORTS?

Esports now rivals traditional sports, with an audience of over 450 million views and annual revenue of $1 billion US [Pannekeet 2019]. For comparison, Major League Baseball has 500 million views and $10.7 billion [Brown 2019], while FIFA Soccer has 900 million and $1.6 billion [Reiff 2019]. Esports also relies heavily on real-time graphics, which is both the field of play for esports athletes and the stadium for its audience. Long before COVID-19, much of esports was remote, making it uniquely prepared to entertain quarantined spectators.

Despite its growing significance and fundamental connection to graphics technology, esports has not received much attention from the SIGGRAPH community, and has been largely neglected by graphics researchers. This panel will bring together esports experts with backgrounds in engineering, medicine, analytics as well as human cognition and performance to advocate that esports become a driving problem for computer graphics.

2 CHALLENGES, BENEFITS AND RISKS

Esports poses technical and human challenges that can drive a range of graphics research. Successfully addressing them would benefit not only esports, but also society more broadly. Yet like any technology, esports is not without human and cultural risks.

2.1 Challenges

To continue its growth, esports faces an array of challenges that will require a deeply multidisciplinary approach, only some of which we sample here. As in most sports, quick response times are a fundamental advantage. Maximizing this advantage requires low-latency interactive graphics systems, with tightly integrated input, rendering and display components. Realizing such systems may drive fundamental changes in real-time graphics technology including alternative architectures and pipelines; and create deeper understanding of human perception and performance, such as the relative importance of visual and temporal detail.

Effective training methodology is still emerging in esports. A new esports science would help athletes train more effectively, with contributions from sports science, medicine and psychology. Technical opportunities include deeply instrumented analytics and biometrics, visualization, AI training partners, simulation, and specialized training interfaces.

2.2 Benefits

Research addressing these challenges will bring a range of broader benefits to society, much as research meeting the needs of film found wide application outside of that industry. Esports' low latency systems could be extremely valuable not only for training but also for telemedicine, remote operation and socially immersive video conferencing, while its training methodologies could prove useful in rehab and remote education. Realizing these benefits will be important if esports research is to find public support.

SIGGRAPH '21 Panels, August 09-13, 2021, Virtual Event, USA

ACM ISBN 978-1-4503-8370-7/21/08.
https://doi.org/10.1145/3450617.3464499

The pro-to-amateur product path of traditional sports give us particular optimism: innovative equipment developed for professionals spreads to consumers, driving demand and lowering price. If esports technology can do the same, then its impact will be even broader.

Science itself may benefit, particularly the study of human performance and perception. Because the field of play is completely synthesized, professional esports tests those limits constantly, creating new questions about, understanding of, and equipment for this sort of research.

2.3 Risks

Any new technology is a mixed blessing, and esports is no different. As we disseminate esports research results, we should consider and mitigate esports risks. That work should begin with further study of those risks, with social scientists and psychologists.

A current example is esports career sustainability. Many esports athletes retire at very young ages. Training can lack expertise and structure, creating unhealthy environments. Athletes must also deal with the rapid evolution of esports: as old games decline, athletes must invest months or years to train in emerging games. Hopefully, any new esports graphics technologies would mitigate these problems, for both professional and casual athletes. More generally, society is already fascinated with traditional sports and worried about technology addiction, so its concern about esports is not surprising. To maintain and increase public support, new esports graphics technologies should address this concern.

3 FORMAT

We will organize our panel into five sections, with the benefits and risks discussed above as a common theme throughout:

- *Introduction (10 mins):* Watson will introduce the panel topic and himself, and ask each panelist to introduce themselves.
- *Graphics and visualization (25 mins):* Watson will pose questions about the 3D environments and abstract overlays that make up any esports experience, and the research needed to improve them. 5 minutes will be held for audience questions.
- *Latency and interaction (25 mins):* Questions will address low-latency systems, how they relate to both tasks and visuals, and the innovations needed realize them. 5 minutes will remain for audience questions.
- *Physical and mental health (25 mins):* Questions will focus on potential risks to personal and societal well-being and how they might be mitigated through improved technologies, training and organizational support, with at least 5 minutes reserved for audience questions.
- *Conclusion (5 mins):* After brief closing thoughts from panelists, Watson will thank the panelists and audience for their time and attention, and announce the panel's contact details.

4 MODERATOR AND PANELISTS

Our moderator and panelists are quite active in esports research.

4.1 Moderator

Benjamin Watson is Associate Professor of Computer Science at North Carolina State University. His Visual Experience Lab focuses on the engineering of visual meaning, and works in the fields of graphics, visualization, interaction and user experience. He has worked for decades on visual technologies, and their relationship to human performance, perception and experience. Watson co-chaired the Graphics Interface 2001, IEEE Virtual Reality 2004 and ACM Interactive 3D Graphics and Games (I3D) 2006 conferences, and was co-program chair of I3D 2007. Watson is an ACM and senior IEEE member. He earned his doctorate at Georgia Tech's Graphics, Visualization and Usability Center.

4.2 Panelists

4.2.1 Josef Spjut. is a Senior Research Scientist at NVIDIA working to improve computer response times for esports and video games. A lifelong gamer, Josef found great joy in the social and competitive aspects of video games, which inspired his Ph.D. research on ray tracing hardware at the University of Utah. Prior to joining NVIDIA Research in 2015, he also spent 3 years as a Visiting Professor in the department of Engineering at Harvey Mudd College.

4.2.2 Caitlin McGee. is a physical therapist (PT, DPT) with a background in neuroscience and exercise/sport science. She is the Co-Owner and Performance and Esports Medicine Director of 1HP, an organization that provides health and performance services to esports players, teams, and organizations. She is also Director of Performance at XO Academy under the Red Bull umbrella. She has been working in the esports medicine sphere for 5 years.

4.2.3 Amine Issa. earned his doctorate at the Mayo Clinic researching the extremes of human performance, with his findings powering development of technology in mobile health and remote monitoring. He also spent decades playing video games, and competed professionally for a couple years. He came to believe that there are many broader lessons in performance that can be learned from the arena of esports. He was able to channel both his performance and gaming passions to found Mobalytics, a performance assessment and optimization platform for gamers.

4.2.4 Wayne Mackey. earned his doctorate at NYU, and followed that with a post-doc at NYU's Computational Neuroimaging Lab, where he studied human attention, memory and decision-making. To do so, he employed neuroimaging, eye-tracking, transcranial magnetic stimulation and virtual reality. In 2017, he founded Statespace, bringing his neuroscience expertise together with data science and video game technology to realize standardized performance analytics in training, with a particular focus on esports.

ACKNOWLEDGMENTS

Joohwan Kim of NVIDIA helped us formulate many of these ideas.

REFERENCES

Maury Brown. 2019. *MLB Sees Record $10.7 Billion In Revenues For 2019.* https://www.forbes.com/sites/maurybrown/2019/12/21/mlb-sees-record-107-billion-in-revenues-for-2019/

Jurre Pannekeet. 2019. *Newzoo: global esports economy will top $1 billion for the first time in 2019.* https://newzoo.com/insights/articles/newzoo-global-esports-economy-will-top-1-billion-for-the-first-time-in-2019/

Nathan Reiff. 2019. *How FIFA Makes Money: Men's and Women's World Cup competitions are major global sports events.* https://www.investopedia.com/articles/investing/070915/how-does-fifa-make-money.asp