

Research and Analysis on the Optimization of Racing Event Viewing Experience Through XR Technology and Gamification

Yang Zhang

*Digital Twin Industry Academy, Chongqing Institute of Engineering, Chongqing, China
zhangyang@outlook.com*

Abstract. In 2024, the Lapz application became really popular, it shows that car racing enthusiasts have a real demand for spatial race viewing. But most current VR race viewing products use a "god's-eye" aerial perspective. They totally overlook the pit garage. This is an important space. It plays an important role in making real-time strategy decisions and analyzing telemetry data. This study put forward a core hypothesis. The paper moves the audience's viewing perspective to the real pit garage, the paper also provide public data like type temperatures, lap times, ERS status. And the paper lets people do simple, lightweight interactions. This can bring a big improvement in immersion and information understanding. The paper looks at how immersion, data understanding, and willingness to keep watching differ under different viewing conditions. That's one key part of the research. The paper also tests if non-competitive gamification mechanisms can encourage people to browse data more. These mechanisms include prediction challenges, achievement badges, and progress bars. The paper combines spatial presence, interactive data visualization, and gamified engagement in this research. The paper hopes it can give empirical support for designing future VR racing event viewing systems. These systems need to truly engage ordinary spectators. The study's findings want to bridge the gap between professional racing data and what casual viewers can understand. The paper also offers practical guidelines to broadcasters and VR developers.

Keywords: XR technology, Gamification, Data interaction, Racing experience

1. Introduction

From watching events on TV in the past to users' immersive experience of watching events based on VR technology, the traditional online viewing mode is developing continuously with the gradual maturity of XR technology. In 2024, an application named lapz was launched on the apple vision Pro platform. Without any commercial promotion, this software has triggered a boom in the whole community. This case shows that users are willing to spend money to buy a spatial viewing experience. Lapz has transformed the audience from the conventional traditional media to the field of space technology. Users enter lapz software based on wearing Apple vision pro, interact with 3D map and select driver's perspective, which significantly enhances users' sense of immersion in online

viewing and greatly endows the audience with the ability to understand real-time information during the game. However, lapz still has obvious limitations, that is, its viewing angle is limited to the aerial view.

Another app, xtadium, launched on the meta platform, focuses on providing an immersive viewing perspective. The enterprise places the fisheye camera on the actual arena, so that the audience can be in the real arena atmosphere, and the immersion sense is significantly enhanced compared with lapz. However, xtadium does not provide detailed data interaction for the audience. Although it puts the audience in a high immersion environment, it lacks the audience's understanding of the data.

This paper will start from the three aspects of immersion, data interaction and Gamification to create a race watching software that integrates three characteristics. Combined with the remote presence theory [1], it will systematically discuss how XR technology and Gamification design can optimize the race watching experience of racing cars. The purpose is to study whether providing professional race information and Gamification design for the audience can improve the race watching experience of racing cars.

2. Overview of related technologies

2.1. Telepresence theory and immersive watching

Telepresence theory is the main theoretical basis of this research [1]. This theory proposes that the sense of presence is not determined by whether the scene is virtual or not, but depends on interactivity and instantaneity. In other words, as long as the user can interact with the media environment in real-time and the information is fresh enough, people's psychological experience at the scene can be generated. This view gives rationality to people to show the real scene of room p to the audience based on VR head display - the audience does not need to enter the actual maintenance station. As long as the interaction is timely enough and the picture is realistic enough, they can have an on-the-spot experience like an engineer.

In watching VR sports events, the sense of spatial presence is significantly positively correlated with the pleasure of the audience [2]. More recent empirical evidence further confirms that compared to standard 2D tablets, consuming sports content via 3D-VR significantly heightens viewers' spatial, interpersonal, and temporal presence, and crucially—the stronger the sense of presence, the higher the viewer's satisfaction with the experience [3]. This shows that enhancing immersion can make the audience more engaged. However, most of their research focuses on the virtual stand situation, and has not yet involved functional areas such as P room.

2.2. Sports visualization and ordinary audience

More than 90% of sports visualization research is for analysts, coaches and commentators, and ordinary audiences are basically ignored [4]. This judgment is very prominent in the field of Racing - the engineer's screen is full of tire temperature curve, brake pressure and ERS energy flow, while the audience can only see the ranking and timing, people developed a set of immersive racing data analysis system, but their users are professional engineers, whose task is to make decisions for strategy optimization, which is completely different from the scene where ordinary audiences only browse and do not make decisions. Therefore, the visual design criteria for racing car data for ordinary spectators is still blank at present [5].

2.3. Gamification and learning motivation

The classic definition of Gamification: apply game design elements to non game situations Meaning Gamification points out that the Gamification mechanism should be associated with the user's actual task semantics, rather than simply stacking points, badges and leaderboards [6]. When studying open data portals, researchers found that non competitive mechanisms such as collections and progress bars can significantly stimulate users' information exploration activities [7]. The interesting interface will not interfere with data understanding, but can extend the user's stay time in the interface [8]. These results provide direct support for the research to carry out the game prediction challenge.

3. Research design

This research designs a professional racing event watching application - pitwall. In reality, pit wall is the core space for team tactical decision-making. It is built on the side of the track. It is not only the place for tactical decision-making and decision-making in the race, but also the area for engineers to communicate with drivers, for example, Figure 1 shows the use flow chart of PitWall.

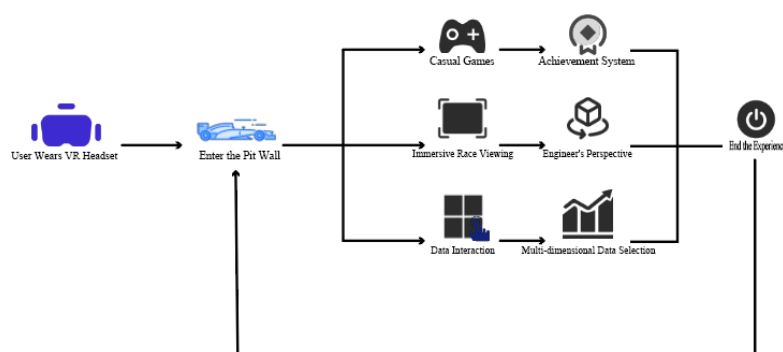


Figure 1. Pitwall usage flow chart (picture credit: original)

3.1. VR immersive

The immersive environment is based on spatial presentation and on-the-spot experience, which makes the data no longer stay in the chart, but integrate into the real competition situation, further reducing the cognitive burden and improving the understanding efficiency Spectators can wear VR head mounted display, and can be derepressed to room P. they can freely switch to the perspective of multiple aircraft positions such as maintenance station and command console, and become virtual fleet engineers for role-playing interaction [9].

3.2. Data is interactive

Interactive data enables the audience to change from passive acceptance to active exploration, understand the meaning of the data in the process of operation, and reduce the difficulty of users' cognition of the data based on instant feedback. Users can zoom, drag, time axis backtracking and multi vehicle comparison on real-time telemetry data, such as clicking on the tire temperature curve of any driver, the system will automatically highlight its various inbound strategies, and pop up the engineer's voice briefing.

3.3. Gamification

Gamification turns watching the race into going through the hurdles, arouses users' curiosity based on the prediction task, and makes data interpretation and unlocking achievements fun in the race experience - for example, 30 seconds before the arrival window opens, the system pushes the prediction challenge: the audience should choose whether the target driver will enter the race, change the tire type, and stop for a long time; Immediately after submission, generate the matching score with the real strategy, and unlock the achievement badge-All mechanisms are established according to the principle of non competitiveness, no ranking list is set and no real-time ranking pressure is introduced [2,10].

4. Conclusion

Starting from lap2.0 and xtadium, two existing application shortboards, this study proposes a set of racing viewing plan - pitwall, which integrates VR immersion, data interaction and non competitive Gamification features. According to the literature review, telepresence theory, self-determination theory and the research on ar/vr help for novice users provide theoretical support for the design at the same time, the existing sports visualization research clearly shows that ordinary audiences have been ignored for a long time, which further strengthens the necessity of this research.

The main assumption of this paper is: shifting the audience's perspective to the real p room, while providing lightweight interaction of public data and non competitive game incentives, can significantly improve the immersion of watching the game, the depth of data understanding, and the audience's willingness to retain Later, this hypothesis will be verified based on user experiments (2 × 2 inter group design, comparison of 2D live broadcast and VR P room, with or without Gamification).

If the hypothesis is true, the practical value of this study will be reflected in three aspects. From the perspective of the P room, this approach can provide F1 TV and other broadcasters with a specific design basis for their products, offer empirical reference for game design in the field of VR sports viewing, and deliver a portable design framework for immersive data viewing of other sports such as football and basketball.

From a theoretical point of view, this study will broaden the application of telepresence theory in the real workspace (P room), and make up for the empirical vacancy of sports visualization for ordinary audiences.

There are some limitations in this study. The experimental scenario is only focused on motor racing, and the designed Gamification mechanism can only predict challenges and achievement titles Subsequent research can try to apply the same design to e-sports, football and other scenarios, and explore the impact of more Gamification elements (such as progress bars and collection brochures) on long-term retention In addition, cooperating with a real fleet to obtain the data flow of the first-hand P room will be an important step to improve the ecological validity.

References

- [1] Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, 42(4), 73–93.
- [2] Tang, T. et al. (2022). Virtual reality sports viewing: Understanding the role of spatial presence. *Communication & Sport*, 10(5), 899–920.
- [3] Kim, J., & Ko, Y. J. (2024). Presence in time: watching live and recorded sports in VR increases spatial, interpersonal, and temporal presence. *Frontiers in Virtual Reality*, 5, 1432888.

- [4] Perelman, A. et al. (2014). A peopleoriented paradigm for sports visualization. IEEE VIS Workshop.
- [5] Waddington, J. et al. (2023). Immersive analysis of spatiotemporal racing data. ACM Symposium on Spatial User Interaction.
- [6] Nicholson, S. (2015). A recipe for meaningful gamification. In *Gamification in education and business* (pp. 1 – 20). Springer
- [7] Li, N. et al. (2023). Open data portals engagement: A crosscountry analysis of game elements. *BMSD 2023*, 241–250.
- [8] Cardoso, B. et al. (2023). KUbism: A playful approach to data exploration. *INTERACT 2021*, 41–51.
- [9] Forsyia, J. et al. (2023). Exploring augmented reality HMD telemetry data visualization for strategy optimization. *Energies*, 16(12), 3196.
- [10] Deterding, S. et al. (2011). From game design elements to gamefulness. *MindTrek'11*, 9–15.