Towards Field Experiments in Esports Competition

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Figure 1: Location of the first eight-player tournament held in SIGGRAPH 2023.

Abstract

Esports is having a significant societal impact. Yet scheduling competitive group play during experiments is difficult, and recreating competitive environments in the lab is challenging. To address these problems, we adopt the field experiment methodology, to create hybrid tournament-experiments — experimentation integrated into the tournament itself. We run two Rocket League tournament-experiments and discuss their methodological and experimental implications.

CCS Concepts

• **General and reference** → *Experimentation*; • **Human-centered computing** → **User studies**; **Interaction techniques**; • **Applied computing** → **Computer games**.

Keywords

Tournament, Experiment, Methodology, Visuals, Esports, Competitive Gaming, User Study, Rocket League, Video Games

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1 Introduction

Esports has grown into an important venue not only for recreation and careers, but also for studying skill, expertise, and performance in computer-based environments [Boudaoud et al. 2022]. However, many experimental studies of esports rely on traditional laboratory-style methods that fail to capture a central aspect of competitive play: the structure and dynamics of tournaments. Competitive matches are shaped not only by game parameters, but also by bracket progression, audience presence, momentum, and players' desire to outperform their peers. These factors are often absent in controlled lab studies despite being fundamental to gameplay and performance.

To address this gap, we organized live tournaments around controlled experimental manipulations, preserving competitive context while enabling experimental design. We refer to this approach as *tournament-experiments*. We situate this approach within prior work on field experiments, esports performance studies, and perceptual tradeoffs in games.

We investigate whether experimental manipulations such as visual fidelity can be studied within competitive tournament settings without disrupting player experience or reducing ecological validity.

2 Related Work

To contextualize this approach, we situate tournament-experiments at the intersection of field experiments, experimental esports research, tournaments as competitive environments, and prior work on visual quality and frame rate.

2.1 Field Experiments

At a methodological level, field experiments introduce controlled manipulations into real-world settings, allowing researchers to study behavior in its natural context while retaining some experimental control [Harrison and List 2004]. Compared to traditional laboratory studies, field experiments typically trade internal validity for increased ecological validity and participant motivation. This tradeoff is particularly relevant in esports, where player behavior is strongly influenced by competitive pressure, social context, and performance incentives.

2.2 Experimental Work in Esports

Building on this, prior experimental research in esports has largely relied on controlled laboratory settings to study variables such as latency, rendering performance, and input devices [Claypool et al. 2006; Kim et al. 2019; Liu et al. 2021]. While these studies provide strong control over independent variables, they often remove the competitive dynamics that shape real gameplay. Research on competition suggests that factors such as pressure, audience presence, and motivation can significantly influence performance [Beres et al. 2021; Tauer and Harackiewicz 2004], highlighting a gap between controlled experiments and authentic esports environments. This disconnect highlights the need for approaches that retain competitive context.

2.3 Tournaments as Research Contexts

Tournaments provide ecologically valid environments for studying performance under competitive pressure, and have been used in both traditional sports and esports research. However, prior work typically treats tournaments as observational settings or convenient aggregations of participants, rather than as components of experimental design. For example, Andre et al. [Andre et al. 2020] measured physiological and perceptual responses during a live collegiate esports tournament, using the tournament as an observational context rather than manipulating game or system conditions. The interaction between tournament structure (e.g., elimination, progression, and seeding) and experimental control remains underexplored. These considerations differ depending on whether an experiment is added to an existing tournament or whether the tournament is structured specifically to support the experiment.

In addition to ecological validity, tournaments must preserve competitive integrity and player experience. Prior work emphasizes factors such as fairness, balanced progression, and overall enjoyment as key properties of effective competitive structures. These considerations are particularly important in experimental settings, where manipulations must not undermine perceived legitimacy or player trust. Some prior work has incorporated tournaments into experimental studies. For example, Rowsell et al. [Rowsell et al. 2009] introduced controlled interventions between matches in a soccer tournament, while Tokey et al. [Tokey et al. 2024] used a tournament structure to study gameplay dynamics in first-person shooters. However, such work typically treats the tournament as a setting for experimentation, rather than integrating experimental design directly into the tournament structure itself.

2.4 Visual Quality and Frame Rate

Within these environments, rendering performance and visual quality are known to affect player experience and, in some cases, performance. Prior laboratory studies have shown that frame rate, refresh rate, and latency can influence competitive gaming performance even at relatively small differences [Kim et al. 2019; Liu et al. 2021], while visual quality primarily affects subjective experience [Claypool et al. 2006]. In practice, esports players often reduce visual fidelity to improve responsiveness [Madhusudan and Watson 2021]. However, these tradeoffs have primarily been studied in controlled laboratory settings, with limited understanding of how they manifest under competitive tournament conditions.

Together, these gaps motivate experimental approaches that preserve competitive context while enabling controlled manipulation. To evaluate the utility of tournament-experiments for esports research, we conducted two Rocket League pilots investigating visual quality and frame rate.

3 Rocket League Pilots

To evaluate this approach in practice, we conducted two tournament-experiments using Rocket League, which supports short, self-contained 1v1 matches while preserving meaningful differences in player skill. This also simplifies logistics, as the short match duration allows tournaments to progress quickly and reduces scheduling overhead.

The first pilot (Fig. 1) [Madhusudan et al. 2024] was an eight-player single-elimination tournament. Matches were played as best-of-three series, with experimental conditions varied across games.

The second pilot expanded the design to a twelve-player double-elimination tournament (Fig. 3), increasing the number of matches and improving coverage across experimental conditions. The larger bracket allowed players to encounter a wider range of visual and frame rate combinations over the course of the tournament.

Across both pilots, we collected data from 20 participants and over 60 matches. The first tournament consisted of 8 players and 15 games, while the second expanded to 12 players and 47 games. Participants opted into the tournament-experiment as a whole; we did not offer a separate non-intervention tournament condition.

3.1 Experimental Conditions

In the first pilot, we used two visual conditions: *low* (L) and *high* (H) visual detail. These corresponded to bundled in-game graphics settings (e.g., lighting, shadows, and post-processing effects), rather than a single parameter change. VSync was also turned off

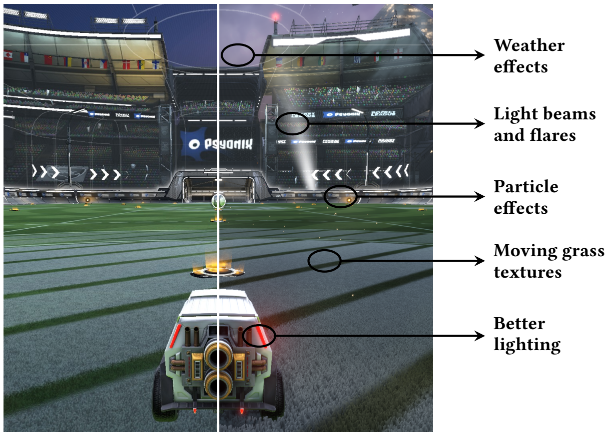

Figure 2: In-game screenshots comparing the two visual conditions, highlighting representative differences. Left: *simple*, Right: *detailed*. Differences include lighting quality, particle effects, environmental detail, and post-processing effects.

when low and on when high. Figure 2 illustrates representative differences between these settings, including changes in lighting, particle effects, and environmental detail. Matches were structured such that each player experienced both conditions within a best-of-three series. Within each best-of-three match, conditions were assigned symmetrically across players. In the first game, one player experienced the high setting (H) while the other experienced the low setting (L), and these assignments were swapped in the second game. If a third game was required, both players competed under identical conditions (either H-H or L-L), ensuring that no player advanced solely due to a favorable setting. In practice, only one match proceeded to a third game, which used the HH condition.

In the second pilot, we expanded this design to include both visual quality and frame rate, resulting in four combined conditions: *simple-low* (SL), *simple-high* (SH), *detailed-low* (DL), and *detailed-high* (DH). Here, "simple" and "detailed" refer to visual settings, while "low" and "high" correspond to frame rate caps (60 and 120 fps respectively). These combinations introduce differences in both visual fidelity and system responsiveness, reflecting both player practice and prior laboratory evidence that temporal factors can affect competitive performance. Across the tournament, we distinguished between individual treatments (SL, SH, DL, DH) and pairings between players. Because the four treatments yield a large number of possible pairings, we selected match pairings dynamically by choosing among the least-used pairings at each step, promoting approximate balance over the course of the tournament. Symmetric pairings (e.g., SL-SL, SH-SH, DL-DL, DH-DH) were deliberately used less frequently - approximately half as often as asymmetric pairings - as they provide less comparative information. Within each match, we followed the same structure as the first pilot: treatments were swapped across players in the second game, and if a third game was required, both players competed under identical conditions drawn from one of the four treatments. While this approach did not achieve perfect balance across all pairings, it

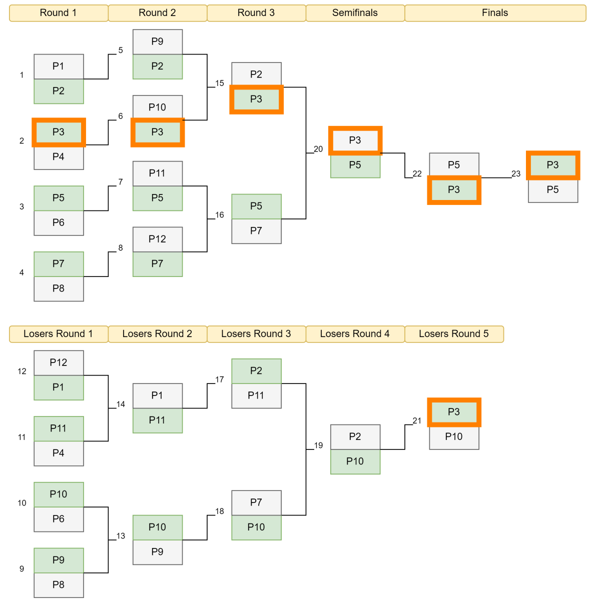

Figure 3: Twelve-player double-elimination bracket. Each pair of boxes represents a match; green boxes indicate match winners, and orange highlights the tournament winner.

produced a near-uniform distribution with intentional emphasis on informative comparisons.

During each match in both experiments, we recorded gameplay metrics including goals, shots, saves, and overall score, along with match outcomes. These measures allowed us to compare performance across experimental conditions while preserving the competitive structure of play.

While the above describes the experimental setup, these designs introduce important methodological constraints specific to tournament-experiments.

3.2 Design Considerations

Designing tournament-experiments requires balancing experimental control with tournament integrity. Unlike traditional laboratory studies, experimental conditions cannot be freely randomized without affecting perceived fairness, player trust, and enjoyment.

To address this, we used best-of-three matches in which players experienced opposing conditions across the first two games. If the series was tied, a third game was played under identical conditions for both players. This ensured that no player advanced solely due to a favorable condition.

At the tournament level, experimental conditions were distributed across matches and rounds rather than fixed to specific bracket positions. This reduced systematic bias, but did not eliminate it: because advancement depends on match outcomes, stronger players naturally progress further and are exposed to more conditions.

These constraints highlight a central tension in tournament-experiments. While laboratory designs aim for strict counterbalancing and independence, tournament formats inherently violate these assumptions through elimination, progression, and skill stratification. Our approach therefore prioritizes symmetric exposure within matches and approximate balance across the tournament, accepting reduced control in exchange for preserving authentic competitive dynamics.

4 Findings

These pilots produced two main findings, along with broader implications for tournament-experiment design.

4.1 Viability of Tournament-Experiments

Participants did not perceive the experimental manipulations as disruptive, reporting minimal impact on gameplay, fairness, or fun. Post-tournament responses were strongly skewed positive (Fig. 4), with a large majority indicating willingness to participate again.

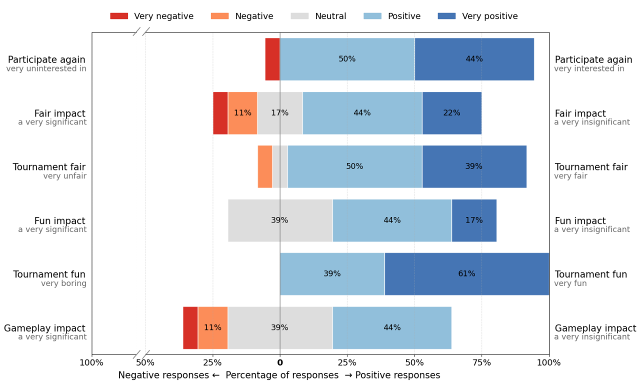

Figure 4: Combined semantic differential ratings from the after-tournament survey across both tournaments. Participants reported how the experimental aspects affected their tournament experience.

Beyond participant perception, tournament-experiments also provided practical benefits. Embedding experiments within tournaments simplified recruitment and scheduling, maintained strong competitive motivation, and yielded data reflecting authentic play under pressure. At the same time, these studies required increased coordination, including multiple experimenters to manage concurrent matches and condition changes.

These results suggest that perceptual manipulations (e.g., visual fidelity) can be introduced within competitive settings, making tournaments a viable context for perceptual evaluation.

4.2 Dominance of Expertise in Competitive Outcomes

Match outcomes appeared to be shaped more by relative player skill than by the manipulated visual and temporal conditions. While we observed variation in gameplay metrics such as goals, shots, and saves across conditions, these effects were small compared to differences attributable to player skill. This effect persisted across both pilots.

This dominance of expertise is not merely a statistical nuisance, but a structural feature of tournament play. As stronger players advance through the bracket, conditions become unevenly distributed across skill levels, making causal effects difficult to isolate. As a result, even when experimental manipulations are applied symmetrically within matches, tournament progression introduces systematic imbalance across the dataset. These observations extend beyond empirical results to broader methodological considerations for tournament-experiments.

4.3 Methodological Implications

Together, these findings highlight a key challenge in tournament-experiments: the interaction between experimental variables and competitive structure. Traditional experimental designs assume independence and balanced exposure across conditions, but tournament formats inherently violate these assumptions through elimination, progression, and skill stratification. For small tournament studies, this may make descriptive, exploratory, or qualitative analyses more appropriate than strong inferential claims.

Rather than treating these factors as noise, tournament-experiments require explicitly accounting for them in both design and analysis. This may include stratifying participants by expertise or ranked bracket, distributing conditions dynamically across rounds, or interpreting results in terms of competitive context rather than isolated causal effects.

This reframes experimental results not as isolated causal effects, but as outcomes shaped by the interaction between perception, performance, and competitive structure.

5 Conclusion

Taken together, tournament-experiments offer a middle ground between controlled laboratory studies and purely observational tournament research, retaining experimental manipulation while preserving authentic competitive dynamics. Our contribution is primarily methodological: we introduce tournament-experiments as a research approach for esports, demonstrate their feasibility through two Rocket League pilots, and highlight the central challenge they raise - balancing ecological validity and experimental control when expertise, fairness, and tournament structure are intrinsic to the studied variables.

More broadly, this work suggests that perceptual and performance-related variables should be studied within competitive contexts, where their effects interact with player expertise and tournament dynamics in ways not captured by traditional laboratory studies.

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