

# Collaboration Challenges of Professional eSports Players in Brazil

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**Abstract**— eSports is a growing economic activity and is receiving international recognition as a sport, including in the next Olympics. This paper explores the collaboration challenges that professional eSports players face during competitions. This is important to understand this relatively new computer-mediated profession allowing for the better management of teams as well as the development of games and supporting systems that consider the challenges of professional collaboration. The data for the study was collected through an online questionnaire answered by Brazilian eSports professional players and it was further analyzed. The results show which roles exist in eSport professional teams and how important non-verbal communication is during matches, and how competition and collaboration occur in a team.

**Keywords**— competitive gaming, eSports, work organization, video games, online games

## I. INTRODUCTION

Competitive games are one segment of the growing online games industry where players compete against themselves, either in groups or individually. Championships offering financial and non-financial prizes made some teams professionalize themselves, specializing in specific games. The concept of eSports (*electronic sports*) emerged from such professional players' competitions.

The potential in eSports is impressive: in 2016, the revenue was US\$492.7 million. Considerable growth is expected for 2020: before the COVID-19 pandemic, the forecasts indicated US\$1.5 billion revenue [1]. Initiatives to take eSports content to the TV are being done [2]–[4], and

there are efforts to compare eSports to traditional sports, in order to turn them into Olympic Sports [5], [6]. Many characteristics of eSports can be considered challenging subjects in the collaboration field, given that players execute a group task while geographically dispersed, demanding situational knowledge sharing in real-time and making continuous and group decision-making.

Collaboration is part of a broader research field named Computer-Supported Cooperative Work (CSCW), the field of study focused on understanding how groups of people work to accomplish a shared goal using computational tools [7]. According to Freeman and Wohn [8], eSports are an interesting research case for Collaboration Studies.

This research analyses the collaborative aspects that arise in professional eSport teams, analyzing how the collaboration occurs in different games, and highlighting differences between male and female professional players. Therefore, in this work we answer the following four research questions:

- How work is coordinated in professional eSport teams?
- How do professional players communicate with their teams during matches?
- How and why professional players compete against their teammates?
- Are there differences between professional players of different genders in terms of coordination, communication, and competition?

We performed a qualitative study to answer these research questions, using a questionnaire with structured and semi-structured questions that were answered by 22 professional eSport players.

## II. ESPORTS

According to Freeman and Wohn [9], eSports is a theme with increasing academic debate, leading to several academic definitions. In this work, we prefer definitions of eSports that are relevant to the Collaboration Studies field. The definition of eSports from Wagner [10], followed by Hamari and Sjöblom [11] consider eSports as being computer-mediated sports, that use Information and Communication Technologies (ICT), in which the practitioners develop physical and mental skills. Freeman and Wohn [9] claim that in the research fields of CSCW and Human-Computer Interaction (HCI), most authors [12]–[17] define eSports as competitive online games. Such competitions range from local matches using private networks to international championships broadcasted worldwide.

The eSports market is already significant, and its growth is expected to continue: the annual revenue forecast for 2020 is of US\$1.5 billion [1]. Another factor that indicates the size of this market is the high value of championships' prizes. Today, more than 40 championships have prizes pools greater than US\$1 million.

Traditional sports and eSports were compared by several authors [9], [18]–[22]. Professional eSports players have a regular training routine and must follow an agenda of events to keep their relationship with sponsors and supporters – as is expected from any professional athlete. Another similarity to traditional sports is related to *fair play*: a player with toxic behavior affects the gaming experience, which may hamper the game revenue [23], and reduce sponsorships; a kind of behavior not tolerated in championships. On the other hand, some scholars criticize eSports by highlighting that it lacks physicality when compared with traditional sports, considering it an unhealthy activity [24]. We believe that similarities between traditional sports and eSports are relevant, given the possibilities that arise from eSport recognition as a real sport. Besides, eSports were included in the 2018 Asian Games (held in Indonesia) as a demonstration sport [25], which opened the possibility of including them in the Paris Olympics (2024) [5]. In addition, following this trend, eSports players are being recognized as athletes. In the United States, professional eSports players may apply for the P-1 visa, the same that traditional athletes use [26], and, in Brazil, eSports regulation is under analysis by the Senate [27]. Besides, in Brazil, several sports clubs, historically related to traditional sports such as soccer and basketball, and private companies are investing in the preparation of eSports players to compete around the world.

## III. COLLABORATION ON ESPORTS

Like the practice of traditional sports, eSports involve collaboration. However, such collaboration occurs through virtual environments and with complex social organization among community players [28]. The several eSport games support teams' collaboration in competitions, making them suitable for the analysis based on the 3C collaboration model (communication, coordination, and cooperation) [29] and awareness [30]. Below, we analyze how the 3C model and the concept of awareness can be applied to eSports [31].

Team members use Communication to decide how to distribute activities among them, synchronizing and renegotiating the activities while the match evolves [31]. According to Leavitt *et al.* [16], the primary communication in eSports occurs through voice and text, mostly due to the fast pace and ad-hoc communication essence. eSports dynamics generally allow some type of non-verbal communication [32]. Some eSport games use *ping* — which are non-verbal communications that mark in-game situations and are acknowledged by the team members — to improve the team's situational awareness. The ping has shown a smaller impact on the player focus than verbal communication [16].

Team members use Coordination to break the main in-game goal into activities, which have partial goals, as well as distributing these activities to the team [31]. How well-integrated the team executes these activities is directly related to the performance they obtain and if the goals are achieved [8]. The shared mental model regarding the activities performed and the interaction between team members, enables predicting the behavior of team members — a phenomenon denominated *team cognition* [8].

Team members use Cooperation to execute distributed activities [31]. Lameiras *et al.* [33] argued that traditional athletes perform two modes of cooperation: conditioned and unconditioned. In the conditioned cooperation, the athletes perceive that they can achieve their personal goals through cooperation with team members. In unconditioned cooperation, however, the cooperation occurs regardless of their personal goals. Lameiras *et al.* [33] indicated that situational factors may induce cooperation.

Team awareness is obtained through communication, coordination, and cooperation [31]. Endsley [34] argued that situational awareness of an individual involves perceiving the relevant elements at the moment, understanding their meaning, and projecting the near-future situation. Situational awareness (or “fostering common ground”) is a key factor in the decision-making process relative to the actions immediately taken during an eSport match.

The most common roles of an eSport team are the player, the captain, the coach, and the manager. The manager has little or no influence during a match; however, the other types of roles do involve collaboration, coordination, and cooperation as communication (verbal, pings, and chat) to improve the information awareness during the match.

Freeman and Wohn [8] emphasized that studying eSports enables discussing collaboration that features hybrid collective work. Such teams mix high-performance with decision-making and knowledge-intensive teamwork. The teamwork in eSports is highly competitive and stressful; it demands rapid decision-making and action-taking, which are associated with physical activities (virtual and non-virtual).

This study considers eSports as computer-supported cooperative work, including the work collective aspect, in which individuals perform physical and mental activities during a championship to defeat opponents, in groups of hybrid virtual teams.

## IV. METHODOLOGY

We present our research design, composed of five components, following the model from Maxwell [35]:

*Goals:* From a theoretical perspective, we seek to contribute to the academic literature about eSports and collaboration, focusing on action eSports games. In practice, we want to explore topics that are emerging in this relatively new field, helping future research.

*Conceptual framework:* We are covering eSports and collaboration research, and we used Freeman and Wohn [8] as our main reference for defining our conceptual framework. Besides collaboration, our study also includes a feedback loop validation with professional players, a conceptual framework from Ergonomics.

*Research questions:* We seek answers to the following four research questions: “How work is coordinated in professional eSport teams?”; “How do professional players communicate with their teams during matches?”; “How and why professional players compete against their teammates?” and “Are there differences between professional players of different genders in terms of coordination, communication, and competition?”.

*Methods:* We developed a 31-item online questionnaire, based on the Freeman and Wohn [8] research, which yielded a total of 22 final responses from professional players. The response profile of the respondents (n = 22) is:

- Gender: 16 male (73%), 6 female (27%).
- Age: 15 to 36 years (mean 22.5 years)
- eSport games played: Counter-Strike: Global Offensive (CS:GO) — 9 (40.9%); Rainbow Six: Siege (R6) — 6 (27.3%); Dota 2 — 4 (18.2%); and Others — 3 (13.6%), which includes Overwatch — 1, Fifa — 1, and Clash Royale — 1.

*Validity:* Feedback loops were used to increase the coherence and validity of the questionnaire and responses by receiving feedback about the questionnaire after presenting it to experienced players and other types of professionals of eSports. We highlight that the interviews were conducted with Brazilian players. The study approach followed three phases:

1. *Preparation:* Some authors of the present study have interviewed eSport professional players in the past, facilitating the execution of the interview. Some interviews were done with four professionals from the eSports industry to validate the literature questions as well as to explore challenges that could be explored. This preparation phase helped in elaborating a consistent questionnaire and data collection methodology. Other eSport professionals then validated the elaborated questionnaire.
2. *Data collection:* We implemented an engagement strategy, in which eSports influencers shared the questionnaire through their social media to obtain more responses.

*Data analysis:* The responses’ analysis was done in three levels: (1) the question itself, (2) the game type, and (3) the player gender. We used the qualitative analysis methodology to find patterns individually in the responses and then collectively compiled the results, using this hierarchical structure.

## V. RESULTS

### A. Coordination

Understanding the work division is fundamental to realize how coordination occurs [36]. Thus, we sought to answer this underexplored question in the eSports literature. Our research explores how the division of work occurs vertically and horizontally. Further, we research which actions are expected for each team player, according to their roles.

During the preparation phase of our research, we learned that the roles of captain, coach, and manager are important in eSport teams. Thus, we aimed to determine the presence of these roles in eSports teams, and if team members have multiple roles (e.g., a player that is also a coach). We also explored the expectations for each role are during a match.

Overall, 82% of the interviewees responded that their teams have captains that play with their teammates. Only 9% responded that their teams have non-player captains, 5% responded that the captain role is shared among the teammates, and 5% responded that their teams have no captain role — see Table I. When analyzing the responses categorized by the game that the interviewee plays, the results show that for Clash Royale, CS:GO, Dota 2 and Overwatch players, nobody responded that their captain is a non-player. Among R6 players, the percentage fell to 50%, but 33% of R6 players responded that they have a captain that *does not* play with them during matches. From these responses, we conclude that the captain role is important, with associated responsibilities, usually given to one team player. However, the captain role can be shared among the players or even be performed by a non-player (although being uncommon).

TABLE I. RESPONSES TO THE QUESTION “IS THERE A CAPTAIN IN YOUR TEAM (SOMEONE THAT LEADS THE TEAM DURING A MATCH)?”

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Yes, there is player captain	82%	75%	100%	100%	100%	100%	0%	100%	50%
Yes, there is a non-player captain	9%	13%	0%	0%	0%	0%	0%	0%	33%
Yes, the team rotates the captain role	5%	6%	0%	0%	0%	0%	100%	0%	0%
No	5%	6%	0%	0%	0%	0%	0%	0%	17%

Upon comparing male and female professionals, we realized that there was more variety in the responses of the male players, which may be explained by the higher number of respondents; however, both groups responded similarly with regard to having a captain that plays with the team.

Regarding what is expected from the captain during the match, the answers showed that the captain must define the in-game tactics, provide moral and motivation for the team, and remain calm under pressure.

Regarding the coach role, the CS:GO, Dota 2, and R6 players indicated the presence of coaches in their teams. However, CS:GO and R6 teams are more likely to have a non-player coach. However, Dota 2 teams are more likely to rotate the coach role, as shown in Table II. In total, 86% of the players responded that they have some kind of coach, and 36% responded that their coach is also a player, in which the role is

either fixed or rotated among them. The presence of a coach is something that differs amateurs from professionals. According to Lipovaya *et al.* [37], coaches are uncommon in amateur teams — in particular, they rarely have a non-player coach.

The responses categorized by the game show that for most games (CS:GO, Overwatch, and R6), the coach is a non-player. In Dota 2, 50% of the players responded that they rotate the coach role.

TABLE II. RESPONSES TO THE QUESTION “DOES YOUR TEAM HAVE A COACH?”

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Yes, there is a player coach	27%	31%	17%	100%	22%	25%	100%	0%	17%
Yes, there is a non-player coach	50%	38%	83%	0%	67%	25%	0%	100%	50%
Yes, the team rotates the coach role	9%	13%	0%	0%	0%	50%	0%	0%	0%
No	14%	19%	0%	0%	11%	0%	0%	0%	33%

When performing the analysis by gender, we noted that the female respondents have non-player coaches (83%) much more than male players (38%). Overall, male players gave more varied responses, which may be explained by the larger number of male respondents.

Before the matches, CS:GO teams expected that the coach provides tactical training, analyses how the team plays, fixes their mistakes, and also helps the players with other issues, unrelated to training and competing. In R6, the coach is responsible for studying the maps and the adversary prior to the match to define the team strategies. In Dota 2, the coach helps define the tactics of the match and provides information about the adversary.

Our results show the existence of the manager role, and they are common among professionals (82%) — having a non-player manager (64%) is over three times more likely than having a player-manager (18%), as Table III shows. The prevalence of non-player managers could be explained because players also expect support from managers in non-game issues, making harder for a player to train and also having the managing role. Managers are more active before and after the matches, mostly taking care of sponsors, championships registration, and marketing.

TABLE III. RESPONSES TO THE QUESTION “DOES YOUR TEAM HAVE A MANAGER?”

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Yes, there is a player manager	18%	19%	17%	0%	11%	25%	100%	0%	17%
Yes, there is a non-player manager	64%	63%	67%	100%	56%	75%	0%	100%	67%
No	18%	19%	17%	0%	33%	0%	0%	0%	17%

We could see the same trend of non-player managers among players of CS:GO, Dota 2, and R6. Comparing

responses by gender, we also see the same trend of non-player managers.

## B. Communication

We analyze in this section how eSport teams perform communication. The chat over voice is universal (100%), followed by text (27%), in-game visuals (14%), out-of-game visuals (real-world signals) (5%), and video conferencing (referred to as video) (5%), as shown in Table IV.

TABLE IV. TEAM COMMUNICATION, BY TYPE.

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Voice	100%	100%	100%	100%	100%	100%	100%	100%	100%
Text	27%	25%	33%	0%	44%	25%	0%	0%	17%
In-game visuals	14%	13%	17%	0%	0%	25%	0%	0%	33%
Out-of-game visuals	5%	0%	17%	0%	11%	0%	0%	0%	0%
Video	5%	6%	0%	0%	0%	0%	0%	0%	17%

When comparing players by game, professionals tend not to use out-of-game visual communication in eSports matches. Upon analyzing the results, we noted that CS:GO players use more text communication than R6 and Dota 2 players; however, they use no in-game visuals at all, which may indicate that the CS:GO game does not support adequately such communication. When comparing players by gender, only small variations in the results can be noted.

We analyzed the activities performed by the teams before matches, which are presented in Table V and classified as:

- Reviewing strategy/tactics: discussing techniques and the players’ responsibilities;
- Warm-up training: training session focused on the preparation for the next match;
- Generic chat: conversation among team members with no relation to the match;
- Concentration: each player focus their attention on the imminent match;
- Adversary focus: conversation about how the next opponent plays and defining the strategies suitable for the match;
- Relaxation: time reserved for the player to relax;
- Nothing: the team has no special preparation for matches.

TABLE V. BEFORE-MATCH ACTIVITIES, BY TYPE.

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Reviewing strategy/tactics	41%	38%	50%	100%	67%	25%	0%	0%	17%
Warm-up training	23%	31%	0%	0%	22%	0%	100%	0%	33%
Generic chat	9%	0%	33%	0%	11%	0%	0%	0%	17%
Concentration	9%	13%	0%	0%	0%	25%	0%	100%	0%
Adversary focus	9%	13%	0%	0%	0%	25%	0%	0%	17%
Relaxation	5%	6%	0%	0%	0%	25%	0%	0%	0%
Nothing	5%	6%	0%	0%	11%	0%	0%	0%	0%

Using the data as the source, By analyzing the collected data (Table V) we noted that CS:GO players usually review their strategies/tactics (67%), and warm up before the match (22%); while Dota 2 and R6 players perform diverse activities. We also analyzed the same data but categorized by the gender of the player. Male players are more inclined to review their strategies/tactics (38%), and warm up (31%) before the match (which may be a reflex of many CS:GO players being men), but they also perform more diverse activities. Female players, however, are well divided between reviewing strategies/tactics (50%), and generic chatting (33%).

We also analyzed the activities performed by the teams after matches (presented in Table VI), which were classified as:

- Post-game review/chat: the team analyze the match to identify and discuss how to correct the mistakes made in the match;
- Watching the match: watching the recording of the last match to identify errors made and discuss how to solve them;
- Training: the team plays more matches to improve their skills.

TABLE VI. AFTER-MATCH ACTIVITIES, BY TYPE.

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Post-game review/chat	45%	50%	33%	100%	44%	50%	100%	100%	17%
Watching the game	14%	6%	33%	0%	22%	0%	0%	0%	17%
Training	9%	13%	0%	0%	0%	0%	0%	0%	33%

Analyzing the post-match activities categorized by the game, we note that approximately half of professional CS:GO and Dota 2 players perform a post-game review/chat; while R6 players usually perform diverse activities, in special post-game training (33%).

When analyzing the post-match activities categorized by gender, we can state that watching the game is more frequent among female professionals than male professionals (33% versus 6%).

### C. Collaboration and competition

We analyze the players' responses about how both collaboration and competition develop in their teams in this section. First, we present results from answers regarding team collaboration, then the analysis of answers regarding the team internal competition.

The analysis of the in-match collaboration (Table VII) shows that most players (59%) see collaboration as the tasks they perform to help teammates: they exemplify collaboration using specific game terminology – e.g., “killing enemies”, “throwing bombs”, and “covering someone”. An example of such collaboration, described by P4 (male, 15, R6 professional): “[I collaborate] when I have to destroy an enemy gadget with a shock drone or incapacitate a colleague so that he can come back with more HP (health points)”. Another example was described by P22 (female, 24, R6 professional): “(...) I usually use the drone at the beginning of the round, assist them with cameras, providing the opening for other team members.”

TABLE VII. INTERNAL COOPERATION, BY TYPE.

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Performing tasks as a team	59%	56%	67%	100%	56%	50%	0%	100%	67%
Discuss and define tactics	41%	44%	33%	100%	33%	75%	100%	0%	17%

Several players (40%) responded more broadly to this question, relating collaboration to strategies, teamwork, and rehearsed plays. One example was described made by P9 (male, 29, CS:GO professional): “I have to help my partners to take others out of position”. The players emphasized that training helps both collective and individual strategy development — especially when improving tactics, as commented by P2 (male, 26, CS:GO professional): “I help the captain at certain moments so that we can finish the match with the right strategy”. Analyzing the answers by the game shows that, compared to CS:GO and R6, Dota 2 is more focused on defining tactics.

The players mentioned the importance of communication in the collaboration: it keeps their teammates aware of what is happening in the match. As commented by P20 (male, 20, Dota 2 professional): “Whenever we ambush someone in a team fight situation, we need to exchange information for practically all actions.”

Finally, when analyzing the answers by gender, we noted only a small variation in the answers, which we interpreted as normal variations in the sample.

When the players were asked about the motivation for within-team competition, 9% of players responded recognition is the main driver (e.g., being the MVP - *most valuable player*) and 27% alleged egotistical reasons — as presented in Table VIII. The comparison of different games highlights that CS:GO could be considered the most competitive, with 77% of the players engaging in some type of competition. One major difference observed in male and female professionals was the lower incidence of competition in female teams — only one of the six women interviewed said that there was competition in her team; whereas 62.5% of men responded that there is competition on their teams. Analyzing the reason for competition among teammates, we noted that men presented more egotistical reasons (31%). The female interviewee who indicated that there is internal competition in her team also responded that it is due to ego. The men also gave other reasons for internal competition (e.g., skill improvement, prizes, and fun).

TABLE VIII. INTERNAL COMPETITION, BY TYPE.

Responses	Total	Gender		Game					
		Male	Female	Clash Royale	CS:GO	Dota 2	Fifa 18	Overwatch	R6
Ego	27%	31%	17%	0%	44%	25%	0%	0%	17%
MVP recognition	9%	13%	0%	0%	11%	0%	100%	0%	0%
Skill improvement	5%	6%	0%	0%	0%	0%	0%	100%	0%
Prize	5%	6%	0%	0%	11%	0%	0%	0%	0%
Just for fun	5%	6%	0%	0%	11%	0%	0%	0%	0%

## VI. DISCUSSION

We discuss in this section the relevant topics for the collaborative perspective after analyzing the responses from the field research questionnaire. We focus our analysis on

three games (CS:GO, R6, and DOTA 2) that yielded the most responses to the questionnaire. Additionally, we contacted professional players to provide their insights on the study results, improving the discussion.

#### A. Coordination

eSports teams of action games may be considered as teams that mix action and knowledge-intensive skills [8], allows us to compare eSports to other kinds of collaborative work (e.g. transit control, trading, and shipping navigation) [38].

Following DeChurch and Mesmer-Magnus [39] classification, eSports teams can be considered as action-oriented. Both R6 and CS:GO focus on operational units in security, enabling a comparison with their “real-world” counterparts, which involves — like Lukosch *et al.* [40] shows — complex and time-limited assignments with adversaries and challenging environments. The games we focused on in this discussion are first-person shooter (FPS) games — in these games, the players experience the virtual world using the point of view of their avatars, which means that they are much more immersed in the action than games classified as a third-person shooter. Additionally, these games allow customization of avatars and weapons, which — besides being a revenue source to the game developer — improves how players identify themselves in the virtual world [41], as well enhancing the player flow [42]. Even avatar friendliness and attractiveness affect the player loyalty to the game [42], [43]. Such factors improve the immersion in the game and the self-identification with their avatars, thus, we can describe action-games eSport teams as being virtual action teams.

Next, we discuss how the work is vertically specialized, i.e., how the work execution is separated from its administration [36]. Our results indicate that the team captain is the person from whom players expect most during the matches; whereas the participation of coaches is more important in the moments before the matches, given that they formulate the team strategies and understand their adversaries. The eSports matches are frenetic, thus, the role of defining tactics also involves the captain, since there are few opportunities for the players to calmly communicate during the match to make complex tactical decision-making [44].

Managers’ responsibilities encompass helping the team both before and after competitions with business matters such as marketing, public relations, and registration in championships. Thus, we conclude that managers have lower importance when compared to the coach and captain during the competition.

The discussion about how the work is horizontally specialized, i.e., how the work execution is split into parallel activities [36], is also made in this fieldwork. The roles available in the games discussed in our research vary due to differences of game goals, and roles with the same name may vary according to the game (e.g., roles *Support* and *Entry Fragger* change from CS:GO to R6). Players change their roles over time, which improves the team’s collective intelligence [44] since changing roles provides the player insights about the teammates’ duties during the match. This kind of rotation of roles is a common business practice, and beneficial to the employees. The literature shows that practice increases employee versatility [45] and enhances career development [46].

#### B. Communication

As Moore *et al.* [47] wrote, social interaction in Massive Multiplayer Online Role-Playing Games (MMORPGs) involves two types of awareness information: real-world and in-game. Our results show that FPS players are susceptible to use both types of awareness information in team communication. In-game awareness visual information was cited by 14% of players, thus, having considerable relevance. *League of Legends* (a strategy game) [16] shown the in-game visual communication importance, and we deduce that this occurs for eSports in general. Consequently, research should be made to evaluate how eSports teams use in-game visual communication. We think that non-verbal communication usage is more frequent than the results from the field research as the literature considers that actions may replace verbal communication in a shared visual space [48]. Nevertheless, players hardly consider seeing teammates’ actions in the shared visual space as a kind of communication, because such communication is tacit by nature.

Cheung *et al.* [38] stated that non-verbal communication is crucial in fast-paced games such as FPSs. The rapid and *ad-hoc* decision-making requires players to communicate quicker than using verbal communication — which is similar for strategy games, but to a lower degree.

Leavitt *et al.* [16] show that non-verbal communication improves the team’s situational awareness, but may also interrupt the players’ flow, disrupting their focus by overloading their attention. Moreover, as argued by Mason and Clauset [49], professional players understand what they must do to help the team, making them less dependent on communication as a whole.

Different from MMORPG players, who rely on text as their main communication method [50], the players of the games researched here rely on voice communication (100%) more than text (27%).

Considering the before-match activities, our results show that the most important ones are reviewing strategy (41%) and warming-up (23%), which account for 65% of the answers. These activities are similar to what happens before competitive sporting matches in general (e.g., in soccer and basketball).

The main post-match activities are reviewing the match (45%) and watching the match (14%). As each team tends to play several games during a championship, these activities done during the post-match are meant to improve the team performance during the championship, as they enable players to identify what worked and what did not and let them discuss how to improve their performance in the future matches.

#### C. Competititon

Gamification is linked to increased competition in games that rely on cooperative-competitive features, even when it is undesirable [51]. Traditional sports have similarities to eSports in many aspects, and their competitive nature is expected [21]. The field research results show that competition among teammates occurs to be chosen as the MVP. Being chosen as the MVP brings visibility to the player, which can lead them to be recruited by bigger teams as the result. Roca and Helbing [52] showed that a balance between greediness and cooperation benefits survival performance. Similarly, we note that the balance between competition and

cooperation in eSport teams is important for their performance.

Ploderer *et al.* [53] discussed another reason for competition: eSport players can be classified as professionals using the definition that they are people who do amateur activities but are paid for it. This type of professional tends to depend on the public instead of a specific client putting pressure on players because only the best ones will be able to earn enough money. This could explain why there is internal competition among teammates (mainly for reasons such as ego, recognition, and prizes, related to a search for increased visibility), as our results show.

In our questionnaire, players could provide their contact information which allowed us to contact two professional players (one plays CS:GO and the other R6) after the analysis. Lipovaya *et al.* [37] indicated that both amateur and professional teams experience a competitive climate. Such climate may be explained by the self-improvement and desire to be “the best”, which are goals shared with traditional athletes. Professionals indicated that competition is necessary to achieve better-paying salaries and extra income sources (e.g., sponsorships), which allows them to turn eSports into a full-time job. As the CS:GO player explains:

*eSport is an intrinsically competitive modality — competition is part of success. The goal of a team is to win collectively. However, the goal of each athlete is to be the best individually, rising on the MVP list.*

As we stated previously, eSports combine conditioned and unconditioned cooperation [33]. The collective work is important to eSport players, paradoxically to the player's personal desire to be “the best”: the team success relies on cooperation and hardly one player will be chosen the MVP playing on the losing team. As the R6 player explains:

*For a team to win, players must be able to collaborate among themselves, balancing the aspects of cooperation and individual competition. It could be a tough day for the ‘star’ of the team... so what? The team cannot let its level drop, and the game is too dynamic, everything happens quickly, so players must be quick on their feet. Not only the reaction speed, but an understanding of the game is also needed.*

#### D. Gender

Our results indicate some differences between female and male players in terms of coordination, communication, and competition. Despite a growing number of publications about gender and gaming, the perspective shown in this paper is still hard to find, given that previous research tends to focus on issues of women being segregated in the gaming environment [54]–[57].

Looking at our results, some differences between male and female professional players can be highlighted and could be further analyzed in future studies. In terms of team roles, all the female players interviewed reported that they have a player captain, while 75% of male players stated this. Our results show that female players tend to have coaches that do not play with their teams (83%). However, the male players' answers revolve around having a non-player coach (38%), having a player-coach (31%), or rotating the role among the team (13%).

When it comes to the type of communication, both genders are very similar, which can be a constraint of the games and championship rules themselves. The only difference worth mentioning is that 17% of female players reported using out-of-game visuals to communicate, while their male counterparts did not report using such a communication method.

Regarding the before-match activities, female players dedicate their time to reviewing strategy (50%) or general chat (33%). Male players also review strategy (38%), but did not report chatting before matches — instead, their second most reported activity was warm-up training (31%), which is not done by the female interviewees. After the matches, female players focus on watching the match (33%); whereas only 6% of male players do so — they generally dedicate this moment to post-game review (50%), which is an activity done by 33% of female players.

It is also worth noting the difference between genders in terms of competition. Only one woman responded that there is competition on her team — and this happens because of ego. This result indicates a perspective regarding competitiveness among women that differs from a study on competitive video-game play, which showed greater competition among women than men [58]. Also important is the fact that ego is the most common reason for competition for both the men (31%) and women (17%) who participated in our study.

## VII. CONCLUSIONS

We aimed to answer four research questions about the collaboration in professional eSports teams in this study.

Regarding the question (“*How is work coordinated in professional eSport teams?*”), the results presented how the work is divided in eSport teams. We listed the expectations for each main role during matches, which let us envisage the coordination of different eSports games.

The question “*How do professional players communicate with their teams during matches?*” involved understanding the methods and tools professional players use to communicate with their teammates during matches. We highlight that verbal communication was considered more important than any in-game mechanics.

In the question “*How and why professional players compete against their teammates?*”, we confirmed the existence of within-team competition, usually motivated by being the best player (and nominated the MVP) and self-improving — which is common in athletes.

The question “*Are there differences between professional players of different genders in terms of coordination, communication, and competition?*” involved highlighting the differences in behavior when comparing male and female professional eSport players. Our work indicates major differences between genders in terms of team roles and competition.

Our study also indicates improvements for game-design of eSports titles: the first improvement is to provide more options of non-verbal communication for players but taking into consideration that excessive non-verbal communication may cause distraction; the second improvement is to analyze the game under development about how coordination is made in real-world conditions (through alpha and beta tests) and use this knowledge to tweak the game mechanics. Thus, we think

that our research can be considered one small step in the direction of using research results to support the eSport game-design.

Our study also has limitations. The data collection period was short and yielded only 22 professional players fully responded to the questionnaires, which weakens our analysis. As our study focus on Brazilian professional players, our results cannot be considered representative of the global eSport community. However, this study is representative of the Brazilian eSport community.

This study leaves some open questions, and opportunities for future research. First, personally interviewing managers, coaches, captains, and players from professional eSport teams to discover how they perceive the roles in their teams – both roles they perform and the roles their teammates perform; how they perceive their teammates' responsibilities; and how players use coordination in championship matches – from the moments before to after the match. Second, we suggest using observation techniques to perform field research to analyze coordination, communication, and competition during championships. Finally, this study helped us to raise new questions:

- Do eSport teams have their performance hindered or improved due to internal competition? What factors make competition be considered helpful or harmful?
- How professional eSports teams consider players' coordination and communication skills in their team-formation?

What collaborative features needed from eSport players are missing in the eSport game-design? How do professional players adapt?

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