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Player-centric networks in *League of Legends*

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ABSTRACT

Online competitive gaming has become one of the largest collective human activities globally and understanding motivations and social interaction is still not fully achieved. The aim of this study is to develop a basis for a systematic classification of player-centric networks in competitive online games based on structural network criteria. Using data extracted from *League of Legends* players, their matches and machine learning techniques, a classification of personal player networks in *League of Legends* is proposed. Results show the resulting egonets can be potentially grouped in four clusters related to their egos playing habits, ranging from solo to team players.

1. Introduction

Quantification of human behaviour and social dynamics has been a long-lasting challenge for social sciences, hindered by two main factors (Szell and Thurner, 2010): first, dynamics of societies constitute a complex system, characterized by strong and long-range interactions (not treatable, in general, by traditional mathematical methods) and, second, data is of comparably poor availability and quality (Lazer et al., 2009; Watts, 2007).

Both factors are, however, played down when looking at massive multiplayer online games (MMOGs) (Castronova, 2005). In the age of Web 2.0 and, more recently, the era of big data (Chen and Storey, 2012), a great deal of social and relational data is routinely generated and recorded in the course of everyday life. This is the world that Thrift labelled as the world of 'knowing capitalism': a world inundated with complex processes of social and cultural digitalization, with generation, mobilization and analysis of social data becoming ubiquitous (Thrift, 2005). It is also a world where sociologists need to rethink their methodological practices in radically innovative ways, as many assumptions that were central in the 1960s and 1970s no longer pertain in the early years of the 21st century (Savage and Burrows, 2009). These changes go even further, as this digitization reworks the very meaning of social relations, as emphasized by Bruno Latour (2007).

This is especially true in online competitive gaming environments, where a wide range of predefined actions for supporting social interaction reflects either positive or negative connotations among game players, and they are in some cases unobtrusively recorded by game servers (Kwak et al., 2015). Often, data is easily available and can be used to study human and player relations as well as behavioural patterns, providing an unprecedented opportunity to observe social interaction on the large scale (Pobiedina et al., 2013). Stenros et al. (2011) distinguished between different kinds of in-game social interaction and reflected how massively multiplayer games were characterized by the formation of both micro and macro communities, complex communication channel hierarchies and diverse degrees of player involvement in social interactions. Taking into account that online gaming has become one of the largest collective human activities globally, we depart from the assumption that "such games provide for both sufficient participation numbers and careful control of experimental conditions, unlike any other social science research technology" (Castronova, 2006). Castronova contrasts this unique chance to replicate entire societies to the small-scale experiments that are often extrapolated to whole populations and communities. When studying MMOGs, the number of subjects can reach over several hundred thousands and their related actions can be counted by millions. The measurement process is also benefited by how information is extracted; players are not consciously of participating in a research-oriented data gathering process, thus minimizing bias.

As video games evolve and MMOG's popularity grows, video game and player culture also grow, but do so supported by the relationships that arise from their social activity (both *online* and *offline*) (Adamus, 2012). Connection is not only a constitutive fact of social life, but also the pillar where online gaming stands. Players influence each other by means of competition or collaboration, exchange experiences and, sometimes, become involved in longer and meaningful relationships, forming teams or communities. Data extracted from online competitive games such as *League of Legends* can help understanding online players and their habits by looking at the structure of their connections and networks during online play.

As finding stable typologies of player networks based on structural

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criteria becomes critical when little information other than the network is provided by data generated by online activities, this paper aims to develop a basis for a systematic classification of player-centric networks in competitive online games based on structural network indicators. In particular, every player (ego) will be related to all the teammates he or she had over a year, obtaining a player-centric egonet where two alters are connected by an edge if they played together in at least one match. The resulting egonets can then be analysed according to their structural indicators and categorized (if such a division exists).

Thus, the objectives of this study are:

1 To discover the hidden structure behind the resulting indicators, if any.
2 To define a limited number of indicators that characterize the resulting structure.

To reach them, the following steps will be followed. First, in Section 2, background will be presented, reviewing previous research and providing further detail about what *League of Legends* is and how it is played. In Section 3, participants, indicators and methods applied to extract and build the player-centric networks will be explained. The resulting network dataset will contain the relationships among hundreds of thousands of players so, in order to infer whether a hidden structure from the resulting indicators exists, a machine learning clustering algorithm will be applied in Section 4. This algorithm will be finally optimized (reducing its complexity) until a satisfactory classification of player-centric networks is achieved. The resulting segmentation is then going to be discussed and illustrated. In the final section, the implications of the results will be summarized, practical applications deduced and limitations and future work acknowledged.

2. Background

2.1. Related work

The most explored MMOGs among researchers are in the category of Massively Multiplayer Role-Playing Games (or MMORPGs). Games such as *World or Warcraft* (WoW) can be linked with the much older MUD (Multi-User Dungeon) text-based games, as they fill a similar niche in the gaming world and, at least to some players, provide a fully social experience (Mortensen, 2006). Zhong (2011) examined the impact of collective MMORPG play on gamers' social capital in both the virtual world and the real world. Ang and Zaphiris (2010) used WoW to investigate the social roles that emerged from the users' behaviour and interaction within its guilds (roughly equivalent to in-game clubs) from an analytical perspective and found that the core members of this communities were highly social-oriented players. In spite of this, Ducheneaut et al. (2006) showed that while MMOGs were clearly social environments, joint activities were not as prevalent as they expected. In particular, social network degree densities for in-game guilds were surprisingly low, forming "sparsely knit networks." Other popular games explored include, for example, *EverQuest* (Castronova, 2006) or *Pardus* (Szell and Thurner, 2010).

In spite of the emergence of studies focused on MMORPG in the last decade, few studies have approached massive multiplayer online games from other genres or subgenres such as MOBA (Multiplayer Online Battle Arena) games. Despite its vast enthusiast community and influence on contemporary game designers, remain under-explored by academics, as existing studies acknowledge (Ferrari, 2013). But few games exhibit a greater need for socially-aware services than this relatively new genre (Iosup et al., 2014), as it brings new ways of collaboration and competition on the table, gender and cultural challenges and even new social networks which need to deal with the inherent toxic behaviour that arises in these contexts. MOBA games such as *League of Legends* provide the same opportunity as other MMOGs: namely the scale (*League of Legends* is one of the most played online games globally), data (which is recorded in its servers and accessible using an API) and relevancy (McDonald, 2017). *e-Sports* are a related phenomenon. Taylor (2012) conducted extensive ethnographic research in this regard, while Trepte et al. (2012) used an e-Sport portal to recruit online participants for their work on how offline factors impact online social capital, thus recognizing the relevance of online gaming for research, now that "online gaming has become a major leisure time activity". Carrillo Vera (2015) claims that the impact achieved by *League of Legends* calls for academic and scientific analysis from a range of disciplines, including sociology, economy or communication; taking into account the amounts of data generated every day, however, computer science should also play an important role. This consideration is echoed by Mora-Cantallops and Sicilia (2018), who identified a research opportunity behind MOBA games as a whole, while calling for "future research to include innovative approaches that combine the traditional and common surveys and interviews with data and computer science techniques."

2.2. The game

League of Legends is a multiplayer online battle arena game that follows a freemium model, but where in-game transactions do little to impact a player's performance or ability. In essence, MOBA games are a subgenre of real-time strategy games in which two teams, typically consisting of five players each, compete against each other with each player controlling a single character. Contrary to real-time strategy games, there is no unit or building construction in a MOBA game, so much of the strategy revolves around individual character development and cooperative team play in combat (Yang et al., 2014).

In every *League of Legends* match, two teams face each other in a single map (the *Summoner's Rift*) with a clear goal: to destroy the opposing base (called nexus). As in most MOBA games, teams are composed by 5 players that interact during the game with the aim of optimizing resources, taking advantage of the opponent's errors and destroying other objectives such as towers (that protect the path to the nexus) and neutral monsters (that provide players with rewards).

Although each team in *League of Legends* is composed by five human players, these can be joined in multiple different combinations, from "solo" (which means that the player enters the queue alone and the matchmaking system finds the rest of the team to play with) to a full team composition. Furthermore, each player takes a role in the team. Current matchmaking system allows players to express their preferences and assigns them to a role, which also has an effect on the range of avatar characters (known as Champions in the game) that the player will choose, as some are better suited for a role than others depending on the meta-game at the time (Donaldson, 2015). Role definitions have evolved from season to season, but stabilized at five main roles. Three players control the lanes (Top, Mid and Bottom) while Support provides utility to the team (spending most of the game paired with Bottom) and Jungle makes use of the resources in-between lanes (see Fig. 1). Players can also choose to "Fill", which means that they will take any free role. *League of Legends* is a team game; all five roles are relevant for the team's success. Even though cooperation is critical for success, communication tools are rather limited: natively, the game only allows text chat and pings (pre-set simple sounds or symbols that can be used as a rough system of communication). Thus, some players that join with friends opt to use external conference tools such as Skype to communicate using voice chat.

In *League of Legends*, players are ranked accordingly to their skill level. There are seven tiers in the so called "ladder", in increasing order of skill: Bronze, Silver, Gold, Platinum, Diamond, Master and Challenger. After a few placement matches, players get placed in competition categories (League tiers), and subcategorized into Divisions. The main objective becomes then to climb the ladder by continuously winning matches. Rank distribution changes over the season and can be different depending on the region, but in general,