

Understanding MOBA Player Experience: What Can We Know from Social Big Data?

ABSTRACT

Multiplayer online battle arena (MOBA) is a popular game genre that has attracted hundreds of millions of active players worldwide. In this work, we attempt to deepen our understanding on MOBA PX from social big data. Methodology-wide, we establish a 6-dimension conceptual framework based on existing PX literatures and recent HCI findings. In addition to the conventional intra-game components (Playability, Learnability, and Sociability), our framework also includes the extra-game components (Reliability, Spectatability, and Culturability). We apply our framework to conduct social big data analytics on the League of Legends North America (LOL NA) online discussion board that contains over one million messages. We have successfully identified emerging trends and uncovered meaningful patterns from the MOBA social big data. Our results reaffirm and contextualize the proposed conceptual framework, and bring insights and new understanding on MOBA PX and the promotion of player well-being.

Author Keywords

MOBAs; player experience; social big data; analytics; topic modeling; sentiment analysis and opinion mining; player well-being.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

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INTRODUCTION

Multiplayer online battle arena (MOBA) is amongst the most popular online game genres nowadays. Major MOBA games such as League of Legends (LOL) and Dota 2 have attracted hundreds of millions of active players worldwide [37, 42]. Despite their immense popularity, player experience (PX) in MOBA games is only understood by a very limited number of studies so far. There are a few pioneer studies conducted by interviews and/or questionnaires (e.g., [20, 36]) that attempted to answer a number of important questions e.g., what draw players to MOBA games and how to promote well-being in them.

MOBA games often come with an official online forum for players to share and discuss about the game. Eventually, a huge amount of comments, which are “gems” for PX researchers to understand the players, have been accumulated. In fact, there have been a growing number of studies which identify emerging patterns and/or draw meaningful conclusions about people from social big data (e.g., [5, 21]). These works combine techniques including natural language processing, sentiment analysis, and social media analytics to distill and discover the underlying information from big online communities [3, 9]. They often become important references for subsequent research studies across multiple disciplines later on.

In the current work, we aim at applying social big data analytics on big MOBA forums to gain a holistic view on MOBA PX. In particular, we have: (1) constructed a 6-dimension conceptual framework of MOBA PX based on a solid body of literatures; (2) performed a number of large-scale analyses on social big data collected from MOBA discussion forums (with over one million unstructured messages) and identified a number of meaningful trends and patterns from the data; and (3) successfully pulled out a number of insights and new knowledge about MOBA PX from social big data; which enrich our theoretical understanding on MOBA PX and contribute effective strategies for promoting MOBA PX and player well-being.

BACKGROUND

The MOBA Game Genre

MOBA combines elements of action games, role-playing games, and real-time strategy games to produce unique game play experience that features a strategic combat between two teams of players. Popular MOBA games include League of Legends (LOL), Dota 2, and Arena of Valor. Each of them alone has a huge fan base of tens of millions of active players [37, 42]. MOBA games share several common principles and map types (which together make up the unique MOBA genre); e.g., there are two opposing teams whose goals are to destroy the primary structure (the base) of their enemy, a player controls a single compelling character in one of these two teams, the characters have various abilities which will be strengthened upon level up, and characters' abilities can improve the overall team performance [20, 36]. International MOBA tournaments (e.g., the LOL World Championship and Dota 2's The International) become eSports that attract an enormous amount of participants and viewers worldwide. The MOBA features and phenomenon create a unique experience on the players that might go beyond our current understanding in terms of general PX.

Related Works in MOBA PX

There are only a limited number of prior works that studied about PX in MOBA games. For example, Iosup *et al.* performed social network analysis to extract and analyze the implicit social structures of a number of networked games including those in the MOBA genre, and suggested that in-game team-play and player matchmaking could impact on PX significantly [18]. Johnson *et al.* performed a questionnaire survey about PX in multiple game genres [20]. Their results showed that MOBA stood out and offered a most distinct PX over other genres such as first person shooter (FPS) and massively online role-playing game (MMORPG). Johnson *et al.* further interviewed experienced MOBA players and identified three key components of MOBA PX, namely competition, mastery, and teamwork. A more recent work was performed by Tyack *et al.* [36] with an attempt to identify ways to improve the well-being of MOBA players. In particular, they carried out an online survey to investigate the social experiences of the MOBA game players and how the play affected their mood. Follow-up interviews were also conducted to further explore issues such as churn (e.g., why a player stop playing) and differences in player satisfaction between playing with friends and playing with strangers. Tyack *et al.* were able to find a number of psychologically positive aspects such as friendship development and mood improvement in MOBA game playing (through team cooperation and playing with friends), as oppose to the toxic and deviant behaviors ever reported on the MOBA players [22, 33]. There are also recent HCI studies that investigate the relationship between MOBA expertise and cognitive skills [6], and also the use of gesture tools in MOBA gameplay [43].

Social Big Data Analytics

Social media and online discussion forums have become a representative and relevant source for big data [3]. Massive number of online users enthusiastically interact and exchange with each others to share their opinions of various goods and services such as movies [1] and cruise tours [27]. Social big data analytics often target to study large-scale phenomena from a holistic point of view by taking all the involving socio-technical aspects into account [8]. The analysis is non-trivial because of the high computational complexity in mega datasets. However, the analysis results can reveal valuable trends and insights about users' opinions and experiences that have been hidden within the big data originally. Next-generation sentiment analysis and opinion mining techniques such as sentic computing [7] and concept-level analysis [26] have also been introduced to better understand the user generated contents by taking principles in human cognition into account.

The Current Research: Understanding MOBA PX from Social Big Data

The current study combines the theoretical background of PX, specific properties of the MOBA genre, and also a number of techniques in social big data analytics to produce a holistic understanding on MOBA PX. We ask the three research questions below:

RQ1: How do we conceptualize MOBA PX and what are the key components that make up the MOBA PX framework?

RQ2: How can we contextualize MOBA PX from social big data and what meaningful patterns and trends can we identify from social big data?

RQ3: What new understanding and insights about MOBA PX can we obtained from the analysis of social big data?

OUR CONCEPTUAL FRAMEWORK

There is a dearth of theoretical framework that explains MOBA PX holistically so far. Before we perform data analytics, we need to construct a conceptual model to guide our analyses. We build on the existing literatures and recent research updates to synthesize and propose a conceptual framework for the MOBA PX (figure 1).

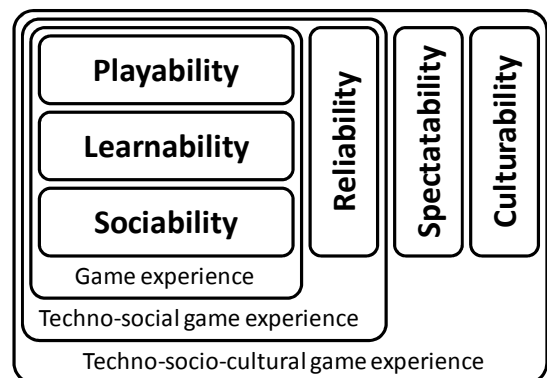


Figure 1. Our 6-dimension MOBA PX framework.

In our framework, MOBA PX consists of a network of interconnected experiences in 6 distinguishable dimensions. These dimensions collectively explain the unique experience exhibited amongst the MOBA game players within and beyond the game environment. We offer our description of each of them below.

Dimension One: Playability

Playability in our framework refers to how one enjoys and be satisfied in his/her MOBA game playing. Similar to usability in UX, playability is the fundamental dimension that characterizes intra-game PX [30]. Playability is related to game-specific attributes such as game narrative and playing context [13], and can be affected by the flow and immersion experiences when the player is situated in and interacting with the game environment [11]. In MOBA game context, playability depends on a number of factors that might motivate the players, such as gaining levels and strengthening their “champions”, and can be shaped by the narrative, social context, and spatial layout within the game [13]. A recent study found that MOBA games offer less presence, immersion, and autonomy but more challenge and frustration to the game players [20].

Dimension Two: Learnability

Learnability refers to the player’s ability to learn and master the objectives, rules, and mechanics of the game and is a dimension inherits from general PX [30]. Learnability is directly related to the game mechanics and rules such as options for interactions within the game [13], and involves aspects such as game knowledge and speed in technique discovery. Game learning can affect a player’s experience, e.g., frustration may occur if the learning curve of the game does not match the skills of the player [26]. MOBA games such as LOL provide a large number of player avatars (which are called “heroes” in MOBA terms) for selection, which allow a great variety in team compositions and store item combinations. As the result, many complex decisions are presented to the players. Experienced players expressed in semi-structured interviews that MOBA games require a high level of strategy to perform well but they receive great satisfaction upon mastering the challenges [20].

Dimension Three: Sociality

Sociality refers to the inter-player social interactions within the game [11, 30, 34]. It is supported by the underlying social processes and interpersonal dynamics during game play [11, 13]. Previous research on non-hedonic gratification in digital games reviewed that playing with another human player can lead to a satisfaction of relatedness and therefore enjoyment [34]. Sociality is a topic that has been studied in most of the existing MOBA literatures (e.g., [18, 20, 33, 37]). Existing perspectives regarding MOBA sociality include: good communication and teamwork are key motivators for the game players [18, 20], playing with friends has a positive effect on PX [36] and promotes game retention [33], but verbal violence and toxic behaviors can drive away the new players (and had been identified from MOBA players [22, 33]).

Dimension Four: Reliability

Unlike the previous three dimensions which describe the intra-game experience of a player, Reliability is a dimension beyond the game environment but contributes to the player’s overall experience in interacting with the game system [41]. Reliability in MOBA PX refers to the capability of the MOBA game platform as a human-computer system to maintain a specified level of performance in the game context of use. MOBA reliability is characterized by a number of UX-relevant properties such as functional completeness and user error protection [19] which can directly affect the players’ satisfaction or cause frustration in game play. Although the relationship between system reliability and MOBA PX is not yet studied in the existing literatures, we include Reliability as an extra-game component in our framework as it can adversely affect the players’ game experience. E.g., system instability and bugs can cause much frustration on players.

Dimension Five: Spectatability

Spectating play is an emerging mode of digital game participation [14]. To be a spectator (who watches a game event without taking part) has become a common experience amongst the MOBA game players. In particular, eSports (competitive video gaming as a form of sports facilitated by human-computer interfaces) have become immensely popular in recent years [16]. eSport events associated to MOBA games have attracted tens of millions of spectators worldwide [38]. In a very recent study, researchers found that eSport spectating frequency is predicted by PX-related variables such as acquiring knowledge about the games, gratification in seeing new game players and teams, and eSports athlete aggressiveness [16]. We include Spectatability as an extra-game dimension in our framework because spectating play has become an indistinguishable MOBA experience amongst tens of millions of the game players.

Dimension Six: Culturability

Culturability refers to the potential and ability of a product to build a new culture [24], and is a merging between culture and usability [2]. Recent ethnographic observations revealed that the MOBA players had developed their own subculture that was unique and game-specific such as expressing their social identity through consistent behaviors in game communications [15]. They also actively share game-related “memes” (which are images with slight changes for humorous) (figure 2).

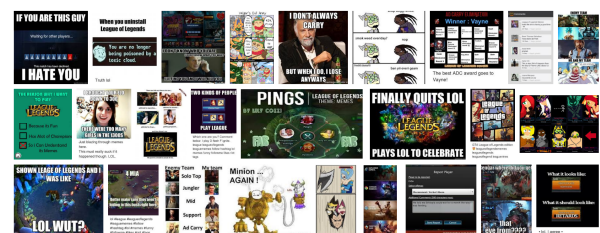


Figure 2. Screen captured from Google image search results using keywords “League of Legends” and “memes”.

Previous research in sport marketing showed that subculture can significantly predict social motivation and sense of community [44]. Although the relationship between player subculture and MOBA PX is unknown so far, we include Culturability as an extra-game component in our framework because the subculture phenomenon has been widely observed and become popular amongst the MOBA players.

METHOD

We performed large-scale analytics on MOBA online discussion forums. Our study was guided the proposed MOBA PX model (figure 1). We applied text mining techniques (including natural language processing and sentiment classification) to navigate, retrieve, and summarize the huge volume of unstructured, textual data contributed by a massive number of MOBA players. In particular, we developed a computer program in Python for data collection, cleaning, and analysis, and used the ggplot2 plotting library in R for visualization. Our program consists of four main modules namely the spider, washer, analyzer, and visualize (figure 3). Crawler etiquette had been observed and followed in our process for ethical crawling.

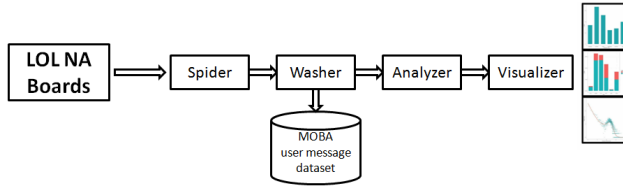


Figure 3. Workflow of our program for data collection, cleaning, analysis, and visualization.

Sample and Dataset Characteristics

Our sample consists of 1,097,424 messages collected from 11 online forums on the LOL North America (NA) Boards (<https://boards.na.leagueoflegends.com>). The messages were contributed by the game players over a 20-month period between 1st October 2014 and 31st May 2017. Each post is made up of two parts: the metadata and the message body. In particular, the metadata records the general quantitative and literal information for each post in a vectorized format (table 1):

Field	Type	Description
ID	Number	The unique ID of each post.
Title	String	The title of a post.
URL	String	The URL of a post.
Upvotes	Number	# of up-votes of a post.
Downvotes	Number	# of down-votes of a post.
Replies	Number	# of replies of a post.
Views	Number	# of views of a post.
Timestamp	Timestamp	Time of post creation.

Table 1. Fields and formats in metadata.

Analysis Framework

Our analysis framework consists of the following:

1. Descriptive statistical and time-series analyses
2. Topic modeling on each of the 11 forums; and
3. Sentiment analysis for each of the dimensions

We manually inspected the scopes, guidelines, and contents of each of the 11 forums and mapped them to the 6 MOBA PX dimensions accordingly (figure 4).

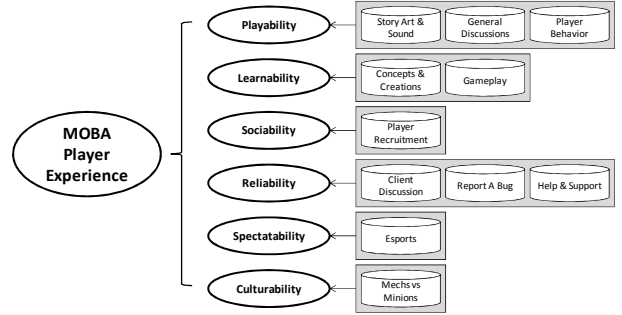


Figure 4. Mapping between the MOBA PX dimensions and LOL NA forums.

Measures

We include a number of metrics for our analysis:

- **Forum Participation:** Measures for player forum participation include the *number of posts* and the *number of replies*. We also define the *reply rate* as the percentage of posts that have received at least one reply. These metrics can reflect how actively the players participated in forum discussion as message posting and replying are restricted to registered LOL players only. The number of *views*, *up-votes*, and *down-votes* of a post can reveal how much attention has been caught by a post on the forum. Unlike posting, replying, and voting, post viewing (i.e. surfing the forums) does not required any player registration.
- **Discussion Topics:** The discussion topics reflect the popular themes concerned by most players. They are represented by a collection of *topic words* obtained by text-mining and topic modeling techniques.
- **Player Sentiment:** The *sentiment score* (a value ranged between -1 and +1) reflects the polarity of the sentiment expressed in a message (positive, neutral, or negative). The sentiment scores are computed by simultaneously applying the tool developed by Thelwall *et al.* [35] and a MOBA-specific sentiment dictionary developed in our current study.

Procedures

Topic Modeling

We performed topic modeling (a text-mining technique for discovering the topics that have been covered in large and unstructured documents [4]) on each of the forums to identify the “hot topics” that have been discussed amongst the forum participants. Our analyses were guided by three principles: (1) topic words that correspond to popular

themes should occur frequently within a forum; (2) the topic words should occur more frequently within the forum than within a general English document; and (3) the topic words should be relevant to LOL or the MOBA genre. We have developed a Python program (using the NLTK library) to extract the topic words, and used a document consisted of 1,077,167 tokens typically appeared in traditional English novels and short essays obtained from [29] as our ground document for comparison. We further inspected the resulted topic words manually to ensure relevancy.

Sentiment Analysis

We have constructed a MOBA-specific sentiment word dictionary with polarity to conduct our sentiment analysis. Most of the current sentiment word bags or sentiment analysis tools are not suitable for our analytics because: (1) game players often use slangs with strong sentiment polarity (e.g., some dirty words in daily life) to express their feelings. However, the existing sentiment word bags contains words that are too formal to be used in the online chit-chat situation (such as the negative words “abhor”, “disdain” and “drab” etc.); and (2) the MOBA players have developed a common set of sentiment words and share within their community such as “rambo”(diving into a fight alone as a suicidal tactic), “noob”(fresh player with terrible skills) and “gg”(stands for Good Game) etc. So it is necessary for us to enhance our sentiment word dictionary in game-specific context. We underwent both manual and automatic dictionary construction processes described below.

- **Manual Construction:** Five LOL players are invited to manually construct a LOL specific sentiment word dictionary. The resulted dictionary consisted of 77 seed words with polarity.
- **Automatic Construction:** We used GloVe (Global Vectors for Word Representation) [28] which is an unsupervised learning algorithm to obtain the vector representations of our seed words; and used the SentiStrength algorithm [35] to automatically expand our dictionary from the 77 initial seed words to a MOBA game context-specific sentiment dictionary with 2623 words.

We further computed the sentiment scores using the tool SentiStrength developed by Thelwall *et al.* [35]. SentiStrength outputs two scores which are integers ranged in [-5, -1] and [1, 5] to simultaneously reflect how negative and how positive the given text is. E.g., “I love [+3] this but I hate [-4] that.” will gives the result (+3, -4). We compute the overall sentiment score of a message by calculating the ratio between the sum of positive and negative sentiment scores and the sum of the absolute values of these two scores. The result ranges between -1 and +1.

RESULTS

Datasets

The following datasets have been produced from our analytics. We have submitted the two files below as supplementary materials of our paper:

1. LOL_posts_datasets.zip which contains 1,097,424 messages collected from the LOL NA Boards from Oct 2014 to May 2017.
2. LOL_topic_words_Datasets.zip which contains topic words extracted from each of the 11 forums.

Descriptive Statistics

Table 2 lists the number of posts and reply rate in each of the dimensions.

Dimension	# of posts (% of total)	Reply rate
Playability	314,335 (28.64%)	85.71%
Learnability	327,364 (29.83%)	81.47%
Sociability	233,822 (15.27%)	58.87%
Reliability	167,578 (21.31%)	48.41%
Spectatability	12,852 (1.17%)	77.25%
Culturability	41,473 (3.78%)	83.39%

Table 2. Number of posts and reply rate across dimensions.

We can obtain an overall impression about the players’ forum participation from the above figures. For example, Learnability, Playability, and Reliability are the three dimensions that stimulated most discussion amongst the players. The players concerned not only their intra-game experience but also the reliability of the game system such as bugs and system stability. A non-negligible number of posts concerning Spectatability and Culturability can also be found, which indicates that the players also concerned about the socio-cultural experiences beyond the game environment. It is also noticed that posts in Playability, Learnability, Culturability, and Spectatability have higher reply rates (than those about Sociability and Reliability); which reflects that the players are more motivated to interact on topics related to these dimensions.

Participation Degrees

Figure 5 (on next page) shows the participation degrees, namely the number of views, replies, up-votes, and down-votes per post in log scale. Similar to other large-scale online communities (e.g., [21]), the number of replies, up-votes and down-votes per post in the Boards follow the power law distribution. We also notice that the number of up-votes is more than the number of down-votes received per post (e.g., the number of posts with 100 up-votes is obviously more than that of down-votes). This shows that the players have a positive perception about the forum discussions in general.

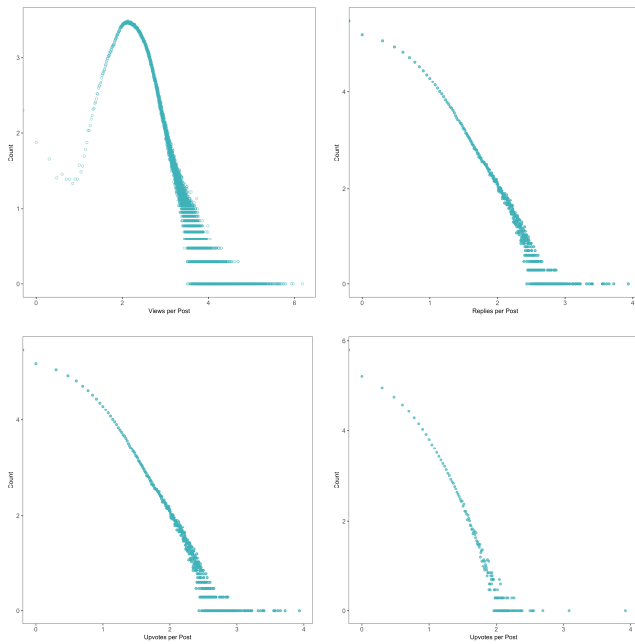


Figure 5. Number of views (upper left), replies (upper right), up-votes (lower left), and down-votes (lower right) per post in log scale.

Time Series Analysis across Dimensions

Figure 6 (on right hand column) plots the time series of the number of posts under each of the 6 dimensions from October 2014 to May 2017 in one month intervals. The Playability dimension shows a continuous decline in number of posts, this suggests that the game design aspects such as story art and sound are becoming more mature and stable so the players might raise fewer questions regarding these aspects. Obvious peaks can be identified from Reliability, Sociability, and Spectatability which show that players' discussions in these dimensions are more time-sensitive. For example, two peaks can be found in Spectatability in October 2015 and October 2016, respectively. This coincides with the occurrence of the famous eSport event, the League of Legends World Championship, which held from in October 2015 [39] and October 2016 [40] in cities across the United States. An obvious peak is also found in Reliability (that consists of three forums in Client Discussion, Report A Bug, and Help & Support) in June 2015, the data reflects that the stability of the game system might face some critical issues at that time and caused a big impact on collective player experience. Nevertheless the system might become more robust and stable afterward, as reflected from the time series of post counts in Reliability.

Topics Discovery by Forums

We have applied topic modeling procedures described in the previous section to identify the popular topics discussed in each of forums. Table 3 lists examples of the topic words discovered from individual forums.

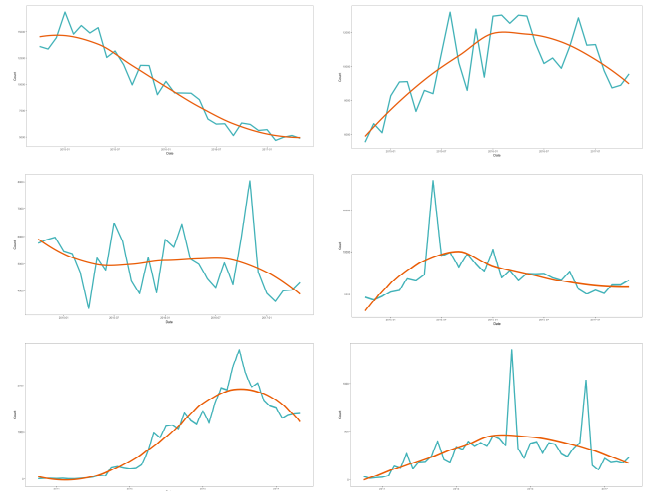


Figure 6. Time series plots of number of posts between October 2014 and May 2017 in one-month intervals for Playability (upper left), Learnability (upper right), Sociability (middle left), Reliability (middle right), Spectatability (lower left), and Culturability (lower right).

Forum	Sample topic words
Story Art & Sound	riot lore splash skins champion update champions jhin team rework lux vu login aurelion taric kindred fiora visual sol updates warwick champ
General Discussion	riot gd team champion ranked games lol players reminder jungle adc mid queue skins bronze riven ap ban zed anime buff
Player Behaviour	banned riot game ban toxic players chat player ranked games perma trolls toxicity afk team reporting behavior queue permabanned bans troll tribunal bots
Concepts & Creations	champion concept skins riot rework champ legends yasuo update zac montage zed champions teemo bard jinx concepts chroma item dragon arcade thresh yorick
Gameplay	riot ranked rework champion nerf buff champions queue team ult jungle q games item yasuo players champ ap nerfs update items adc tank op champs meddler solo
Client Discussion	client alpha select game champion champ bug screen chat item riot beta sets profile mastery update feedback button ranked masteries legacy lobby option queue games
Report A Bug	bug gameplay client game select ult q champion screen champ w crash ranked riot bugged patch bugs glitch queue loading chat mastery aram mac azir ip sion visual
Help & Support	game league client riot ping error server screen lag lol patch rp connect ranked bug pbe login fps champion legends chat games update champ reconnect queue mac
Player Recruitment	team lf ranked duo gold plat 5s adc top mid diamond players laner bronze dynamic jungle jungler flex player ip climb recruiting gaming lft season supp smurf aram
Esports	lcs worlds na team vs tsm tournament eu riot skt c9 teams clg fantasy 2016 finals gaming 2015 lol championship msi players split legends pro games 2014 tickets rp
Memes vs Minions	team champion fed riot adc tfw ult yasuo vs champions champ teemo mains jungler legends nasus nutshell jhin riven ranked jungle lol bot memes rito players

Table 3. Sample topic words by forums.

Three types of topic words are discovered:

1. **Common Words with Common Meanings:** These are words that can be commonly found in the Boards and a general English dictionary. E.g., “team”, “game”, and “chat”.
2. **Common Words with Specific Meanings:** These are words that can be found in a general English dictionary but have special meanings for the LOL players. E.g., “champion” (the character selected by a player during a game), “skin” (skins can produce certain splendid effects for the champion), and “bronze” (certain achievement level in the game).
3. **Game Specific Words and Abbreviations:** These are words or abbreviation that are specific to the LOL game context and are rarely found in general English dictionary. E.g., “yasuo” (the name of a champion) and “CLG” (a famous professional team in LOL).

The identified topic words enable game researchers and developers to have a more concrete idea about the popular themes concerned by the players under each of the MOBA PX dimensions.

Player Sentiment across Dimensions

We used the procedure described in the previous section to produce a sentiment dictionary with 2,623 words, in which 77 are the LOL context-specific sentiment words (table 4).

pro(+), crazy(+), overextending(-), rambo(-), garbage(-), counter jungle(+), cover(+), izi(+), bad mannered(-), ffs(-), focus(+), off meta(-), abam(-), gg(+), active(+), overkill(+), queue dodge(-), kill(+), all draft all mind(-), carry(+), gl(+), all blind all mind(-), nerf(-), troll(-), clutch move(+), nj(+), suicide(-), noob(-), afk(-), all random all bottom(-), care(+), panta(+), gj(+), install kill(+), bm(-), toxic(-), utility(+), blind pick(-), nerfed(-), smart(+), skilled(+), scrub(-), op(+), overpowered(+), facecheck(-), overtuned(-), collapsed(-), lag(-), wombo combo(+), dc(-), arab(-), shitty(-), nuke(+), stronk(+), report(-), suck(-), hf(+), bug(-), counter pick(+), aram(-), qq(-), stolen(-), ragequit(-), off tank(-), steal(+), collapsing(+), babysit(+), spamming(-), counter gank(+), open mid(-), surrendering(-), lag spike(-), unstable(-), adam(-), install(+), all random all mid(-), push(-)

Table 4. Game specific sentiment words with polarity.

Using the resulted dictionary, we further computed the average sentiment score for each of the forums and dimensions. The results are provided in Table 5 (on right hand column).

The sentiment scores reflect positive (> 0), negative (< 0), or neutral ($= 0$) sentiment amongst the players in a certain forum or dimension. It is shown from our results that player sentiment in Sociability (and its corresponding forum, Player Recruitment) is the most positive. Player sentiment in Spectatability (and its corresponding forum, eSport) is the second most positive. However, a strongly negative player sentiment is found in Reliability (in particular the “Report A Bug” forum). Player sentiments in Playability, Learnability, and Culturability were nearly neutral.

Dimension	Forum	Sentiment score of dimension	Sentiment score of forum
Playability	Story Art & Sound	0.0208	0.0264
	General Discussion		0.0248
	Player Behaviour		0.0325
Learnability	Concepts & Creations	0.0123	-0.0018
	Gameplay		0.0144
Reliability	Client Discussion	-0.2360	-0.0667
	Report A Bug		-0.3409
	Help & Support		-0.1067
Sociability	Player Recruitment	0.2800	0.2800
Spectatability	Esports	0.1018	0.1018
Culturability	Memes vs Minions	-0.0052	-0.0052

Table 5. Sentiment scores by dimensions and by forums.

DISCUSSION

Demystifying and Conceptualizing MOBA PX

Playing online games has become one of the most popular activities amongst Internet users nowadays [10], whilst MOBA is a major online game genre that has attracted hundreds of millions of active online game players. However, there is a dearth of knowledge about MOBA PX. Although MOBA games can bring gratifications, satisfaction, and a number of positive experiences to the player, negative experiences such as verbal violence and toxic behaviors had also been identified from MOBA players ([22, 33]). Also, MOBA games have been described as a societally isolated genre [12]. So far the society has only very limited knowledge about what have been experienced amongst the MOBA players. It is critically important to understand this big Internet user group, not only for enhancing their PX by designing better games, but also to formulate effective strategies that can promote their well-being [36].

In the current work, we have conceptualized MOBA PX by constructing a framework based on a solid body of existing literatures (e.g., [11, 13, 25, 31, 34, 36]) and recent research findings (e.g., [6, 18, 20, 22, 33, 36, 43]). We expanded our framework from conventional intra-game dimensions (Playability, Learnability, and Sociability) and included

also the extra-game dimensions. Specifically, we introduced Reliability as techno-social game experience in our framework as it can affect PX adversely (e.g., system failure can lead to frustration in players.) Furthermore, we also incorporated two techno-socio-cultural dimensions namely Spectatability and Culturability that might help to explain MOBA PX holistically.

Echoing the urge from the HCI community (e.g., [36]), our 6-dimension framework can help “demystifying” the MOBA genre and enable researchers and practitioners to conceptualize MOBA PX and identify effective strategies to promote positive interactions, social connectedness, and the well-being amongst the players.

Contextualizing MOBA Player Experience from Social Big Data

We contextualized MOBA PX from our analytics over a massive volume of discourses transacted by the MOBA players. These discourses are social big data which covers a variety of aspects related to the players’ own game experiences. Our analytics allow one to uncover patterns and trends regarding a wide spectrum of aspects in MOBA. We briefly discuss our findings below.

- Topics concerning all of the 6 MOBA PX dimensions in our proposed framework have ever been discussed by the players. In addition to dimensions that correspond to the intra-game experience (Playability, Learnability, and Sociability), non-negligible portions of discourses were also found in the extra-game dimensions namely Reliability, Spectatability and Culturability. These suggest that all dimensions in our proposed framework are valid PX components that have been experienced by the MOBA players.
- A number of emerging trends can be identified from the time series analyses of our data. This enables one to draw meaningful conclusions about collective MOBA PX. E.g., the overall declining trend detected from the Playability dimension might suggest that the players were eventually familiar with the game design such as the game story and champions; whereas such trend not be found in Learnability, suggesting game knowledge and skill development is a dynamic process and the players have been involved in a collaborative game learning process continuously through their forum participation.
- A number of peaks that temporally matched with the social events of the game (e.g., the LOL World Championship) are identified from the time series data (e.g., that of the Spectatability dimension). Such time sensitiveness of the data suggests the possibility of MOBA PX prediction from social big data, which is an open problem that worth further investigation.
- We have discovered the specific topics under each of the dimensions (refer to table 3 and our supplementary dataset). This can deepen our understanding about MOBA PX by contextualizing the abstract conceptual

framework with concrete themes and topics that had ever been discussed by the players. Our topic modeling have also returned a number of game specific terminologies and abbreviations, which further contextualized MOBA PX with the players’ actual game experiences and subculture.

- Sentiment analyses across each of the 6 dimensions reveal that the Sociability dimension of PX has produced the most positive experience in MOBA players. Such finding aligns with a number of existing research results e.g., [20, 36]. Our analysis further discloses a negative polarity in Reliability, this result affirms our inclusion of Reliability as a valid extra-game component in the MOBA PX framework by demonstrating that reliability factors such as bugs and system stability can affect the mood of the players substantially (e.g., causing frustration).

The above findings not only contextualize MOBA PX with real world social data, but also enable the HCI community to pull out insights from the data so as to better understand about the players and derive evidence-based design strategies for MOBA PX enhancement.

Insights and Implications

In the current study, we have constructed a 6-dimension framework to conceptualize MOBA PX and have further contextualized MOBA PX through the analytics of social big data generated by MOBA game players. Our findings enrich the theoretical understanding on MOBA PX. Moreover, by connecting our empirical findings to the existing literatures, we are now better informed about the attributes affecting MOBA PX, and be able to formulate evidence-based strategies to enhance PX and achieve other societal goals such as promoting players’ well-being.

Theoretical Implications

Most of the existing studies in digital games focus on PX within the game environment. On top of the intra-game PX components (namely Playability, Learnability, and Sociability) that have been covered in most the existing literatures, we have expanded the theoretical framework by including extra-game dimensions (namely Reliability, Spectatability, and Culturability) and support our proposed framework with empirical evidences and findings obtained from social big data analytics.

A number of results obtained from our analyses align with the findings in existing literatures. For example, MOBA research results suggest that in-game social interactions such as teamwork and communication can produce a positive effect on MOBA PX (e.g., [18, 20, 36]). Our result further shows that players exhibited the most positive sentiment in activities related to Sociability, e.g., when they were interacting with potential team players over the online forum.

From our time series analyses, we find that learning is a “life-long” experience amongst the game players. This is

reflected by a time-invariant forum participation pattern in the Learnability dimension (figure 6). A detail inspection on the discussion contents revealed that the players had indeed engaged in “collaborative learning” over the online forums and collectively produced new knowledge about game skills, coordination, and game tactics. In other words, knowledge building activities [31] have been observed from the MOBA game players along their game learning experience.

We have introduced Spectatability and Culturability as two new dimensions in our MOBA PX framework; and have offered empirical evidences to support our inclusion of these two techno-socio-cultural components. Nevertheless, spectating play [14], or being a game spectator without actual participation in fact is a form of situated learning and legitimate peripheral participation in community of practice [31] and might enhance game Learnability. Also, it has been proven that development of subculture can promote social motivation and sense of community [44]. Hypothetically speaking, these extra-game experiences can promote overall MOBA PX. Our results and initial findings (including the topic words that have been discovered from forums concerning Spectatability and Culturability) might engender future studies in these directions.

Design Implications

Social big data analytics enable one to draw meaningful insights from a massive volume of data which were originally unstructured (or semi-structured) [3, 8]. Our current study offers a number of unique insights for MOBA PX design and player engagement.

- While players have eventually familiarized themselves with the game story and design (as reflected by the stably declining trend in the Playability time series), they continue to actively exchange with one another on game knowledge and skills. In order to maintain a high level of player participation and attention, new characters and tactics can be launched from time to time to promote PX through Learnability.
- Players are sensitive to system performance (as reflected by a sharp peak in the Reliability time series), in particular, server error and bugs (which are the topic words identified in Reliability) have ever caused a negative mood in the players (as reflected by the strongly negative sentiment score in the “Report A Bug” forum). Game producers must ensure the stability and reliability of the game system as players might attribute their MOBA PX to Reliability of the game system.
- Positive sentiment has been recorded from both the Sociability and Spectatability dimensions. In particular, periodical sharp peaks are observed in coincidence with the annual World Championship event. This affirms that MOBA tournaments are not only an effective event for marketability but also produce a positive impact on MOBA PX.

The HCI community has also been inquiring into effective strategies that can promote MOBA player well-being [36]. Our MOBA PX framework and analytics results provide the stakeholders (not only the game researchers and practitioners but also the players as well as their friends and family members) a more holistic and contextualized understanding on MOBA PX, so as to design and formulate effective strategies for player well-being. For example, our results show that Sociability is a key component in MOBA PX that contributes to positive mood in the game players. In addition to communication, teamwork, and playing with friends [18, 20, 36], our study has found that the team member recruitment process itself can also cause a positive sentiment in players. One more forward-looking strategy to avoid social isolation from the “outside world” [12] and/or mitigate immersed frustration in MOBA players is to have outreach social work services be accessible to the MOBA virtual world.

Limitation and Future Work

Our work is an initial effort within the HCI community to understand MOBA PX from social big data. There are a few limitations in our current study which might motivate future studies in this direction. For example, our data only came from the League of Legends North America Boards which included only one MOBA game and one geographical community (although this is the major forum of a leading MOBA game). Our results could be more representative if we also include data collected from other geographical communities (with participants having different demographics and cultures), or extend our analytics to other MOBA games. Secondly, we mapped the LOL NA forums to the dimensions in our framework upon manual inspection (which was backed up by a rigorous review on a solid body of literatures). As a future work, partitioning algorithms and clustering techniques (see [3]) can be applied to the entire body of the Boards messages for automatic dimensions discovery. Lastly, the current study was performed on collective MOBA PX emerged from a large number of players. Individual differences amongst these players must be noticed and acknowledged.

CONCLUSION

In this paper, we proposed a conceptual framework for MOBA PX that consisted of 3 intra-game dimensions (Playability, Learnability, and Sociability) and 3 extra-game dimensions (Reliability, Spectatability, and Culturability). Guided by this framework, we further applied social media analytic techniques to collect, analyze, and visualize a huge volume of social data generated by the MOBA game players. We successfully uncovered a number of meaningful trends and patterns from the data and gained new understanding and insights on MOBA PX from our results. We also discussed the theoretical and design implications of our findings. Our work is amongst the initial efforts in studying MOBA PX from social big data. We hope our results and findings can provide a better understanding on MOBA PX, so as to inform about

effective strategies for PX enhancement and player well-being promotion. We hope to engender further works and discussions in this direction.

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