論　　文

Analysis of derogative terms usage and toxicity in conversation between players

― Comparison of League of Legends and DoTA2 ―

オンラインゲームにおける侮蔑語と毒性の分析

― League of Legends とDoTA2の比較 ―

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Abstract：In this paper, we analyze the verbal behavior of players of two prominent competitive multi-player online games, Defense of the Ancient 2 (DoTA2) and League of Legends (LoL), focusing on the usage of derogatory terms and toxic behavior. With rising popularity of online games, they are becoming a part of mass culture; League of Legends being world's most played PC game in 2019. They are considered an e-sport when played professionally, generate huge revenue and have large prize pools for tournament winners. However, online gaming is often accompanied with toxic behavior between players in a match, whether spoken or written. In order to combat the negative atmosphere, a filtering system for derogatory terms was implemented in League of Legends. We argue that the filtering system affects the way players interact in the game, but does not necessarily make them less toxic to each other. We explored this hypothesis by analyzing the chat corpus of 25 recorded matches from DoTA2 without the filtering system, and 25 matches of LoL with one. The transcribed chats were analyzed and compared by examining word frequency and extracting keywords related to gaming. We found that players talk to each other in a significantly different manner in both games, using more neutral and short terms in DoTA2 and more emotional and extreme terms in LoL. They use an equal amount of derogatory terms, but in League of Legends players tend to use more creative and elaborate curse words in order to avoid being filtered. We concluded that the filtering system failed to prevent toxicity, and may even have caused resistance in the players, contributing to more extreme choices of derogatory terms.

概要：本論文では，勝敗が重要なオンラインゲーム２種のプレイヤー（ゲーマー）のチャットログ，主に毒性のある行為や侮蔑語の分析を行う。オンラインゲームは，この二つのゲーム（Defense of the Ancient 2，あるいはDoTA2とLeague of Legends，あるいはLoL）だけではなくますます人気を得て，大衆文化の一部になっている：LoLは2019年に最もプレイされたPCゲームと称された。プロのレベルになる場合は，これらのゲームはe-sportと呼ばれ，トーナメントがあり賞金も普通のスポーツ並みである。だが，オンラインゲームは書き言葉でも話し言葉でも，常にプレイヤーは毒性のある行為を行ったり受けたりする可能性がある。そのマイナス面に対して，LoLや多くのゲームにはフィルタリングシステムを発展させて運用してきた。しかし，フィルタリングシステムではプレイヤーの対応は変えるが，ゲーム内の毒性は変わらない。その仮定を証明するため，筆者は各ゲーム（フィルタリングシステムが無いDoTA2とフィルタリングシステムがあるLoL）を25戦記録してプレイヤーのチャットログを分析した。分析したチャットログから異なる言葉の回数や割合，またゲーミ

ングに関するキーワードを比べた。結果，二つのゲームのプレイヤーのチャットログには大きな違いがあることが分かった：DoTA2のプレイヤーは主にニュートラルで短い言葉を使い，LoLのプレイヤーはより感情的な言葉や極端な用語を使用する。二つのゲームにおいて侮蔑語はほぼ同じ回数使われていたが，LoLプレイヤーはフィルタされないように，新しい侮蔑語を使う傾向がある。結論として，フィルタリングシステムは毒性を止められず，逆効果になり，プレイヤーの抵抗感を発生させ，プレイヤー側からより激しい言表を招くことになると考えられる。
Keywords：online gaming, MOBA, gaming culture, toxicity, sociolinguistics, corpus analysis

1. Introduction

Toxic behavior or toxicity is a term which denotes behavior which is harming others. According to Blackburn and Kwak [1], in recent years, with the rise of online gaming, toxicity has established itself as a well-known problem in the online games community. Toxic behavior usually manifests in the verbal form, ranging from hurtful words to deadly threats [2]. Toxicity is especially common in the multiplayer online games, such as multiplayer online battle arena genre (MOBA). The most played games from the genre are DoTA2 and League of Legends (often referred to as LoL). As one method of solving the toxicity problem, the League of Legends developers, Riot Games, have introduced the filtering system which excludes and censors the derogatory terms most commonly used by the players. The suggested solution served its purpose well, at least at the first glance. The derogatory terms and curse words are being blocked in the game chat, but does this really mean that players are behaving less toxic, or have they adapted their language to work around this system? In order to check this, we will compare chat transcripts from recorded matches in DoTA2 without the filtering system, and LoL with one. We will analyze the chat transcripts corpus and compare most commonly used derogatory terms.

2. Background / Overview

Gaming culture has developed in the second decade of 20th century, with simple table tennis simulator called Pong released for Atari in 1972. Games have now grown more complex, with excellent graphics comparable to reality. Games nowadays are useful for a variety of purposes, ranging from early childhood education [3] to studying computer science [4]. Early gaming was often focused on a single player (e.g.: Pong, early Final Fantasy series), later branching out into two-player games (mainly arcade games like Street Fighter, Tekken, Contra and Final Fight series), and finally to multiplayer games (shooting games like Counter Strike or role-playing games like Monster Hunter World).

By connecting players to a server, they are allowed to interact with each other. These interactions might be in the form of words (chat), of images (emoticons) or of actions (programmed movements and actions). From the perspective of a researcher, they can be considered a pseudo-society simulation, but the online societies existing in the cyberspace developed into their own, new societies. As online gaming is both competitive and often anonymous, participants began showing types of behavior they would not display outside the online community. Without societal boundaries and judgment, we can witness the winners looking down on the losers, individuals blaming the society for their thought-to-be injustice, the meek and docile people turning aggressive and cursing everyone. Of course, this kind of behavior does not happen in all online games and in all instances, but it is fairly common and it is labeled as toxic behavior [2].

According to PC Game Tracker's World game ranking [5], the most played games in the world are multiplayer games such as League of Legends, Minecraft (combining single player and multi-player gaming), Counter-Strike: Global Offensive, Fortnite, Overwatch. The internet enabled the emergence of new genres as well such as Multiplayer Online Battle Arena, or MOBA. This type of game is not only popular (League of Legends in ranked 1st and DoTA2

12th in the world games ranking), but also generates great revenue both for players and people involved in development and marketing.

2.1 Gaming as a sport

According to [6], some games share many characteristics with sports and could be classified as such, as they are physically demanding, skill is needed to master them, and competitiveness is part of the entertainment. As such they are called e-sports, and getting more official recognition. In 2013, the US government has started granting P-1 Visas, which are usually granted to athletes and to professional e-sports players [7]. There have also been talks about how e-sports are going to be a "demonstration title" at 2024 Olympics in Paris, as a "demonstration event" at the 2018 Jakarta Asian Games, and set to have it debut "as a full event at the multi-sport tournament at Hangzhou, China in 2022 [8]. In eight US states, for example Connecticut or Kentucky, it's also reported that video games have become an official varsity sport in high school [9]. These events prove how e-sports are being increasingly recognized as a kind of sport around the world.

There is also a notable growth of the E-sports industry. Global E-sports Market Report (Figure 2.1.1) shows the growth of revenue and projections for the future. We see that Global E-sports Market Report in 2016 projected an expected audience growth of 15.9% and even larger revenue growth of 40.7% [10]. In fact, in the moment of writing this article, the global e-sports market has exceeded the expected growth shown above [11].

Just like most physical sports, each game in the e-sport category has their own championship or tournament, and sometimes even multiple are held throughout the year. There's also a huge fan base and sponsorship that's comparable to some of the big sports. League of Legends, for example, has 67 million players and has grossed an estimated US$1.25 billion in revenue in 2015 [12]. DoTA2, although it doesn't have as many players nor as high a gross revenue as that of League of Legends, it has one of the largest prize pools in the e-sport industry - the TI championship. Total prize pool for DoTA2 in 2018 was $25,532,177, and for LoL $6,450,000 [13]. Compared to 2016, it was about 20% higher for both games.

2.2 Toxic behavior in gaming and introduction of filtering systems

These games symbolize the new era of gaming, but unfortunately, they have become infamous for players' toxicity towards (but not limited to) new and unskilled players. It mostly manifests as harassment by words, either by voice chat or text chat. Sometimes, the behavior of players goes over the digital border, such as the practice of calling SWAT teams to the house of the player who angered another. Some of the unfortunate incidents ended

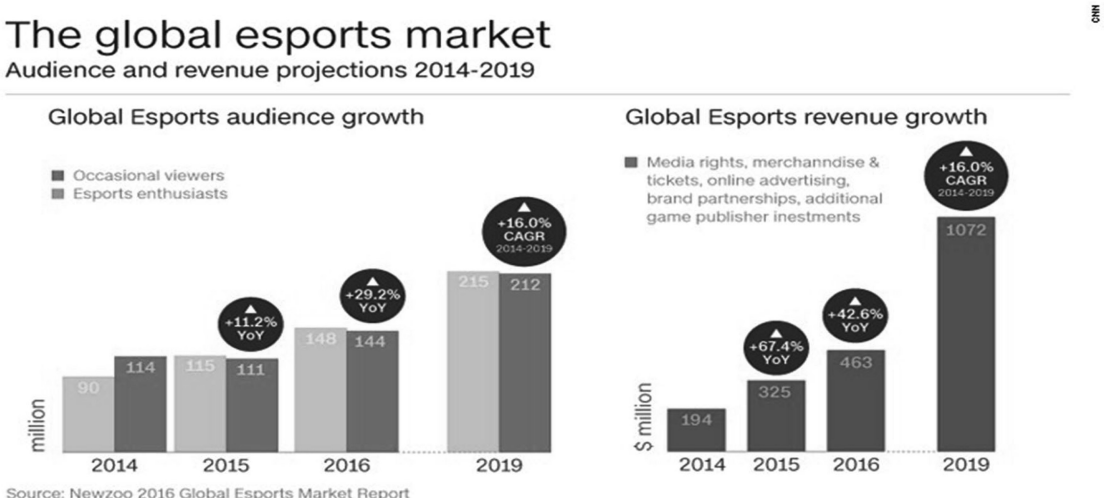

Figure 2.1.1: Global e-sports market

in accidental deaths and imprisonment of players [14, 15]. There is also a subgenre of toxic behavior aimed towards female players [16], and we note that sexism has blended the gaming society [17]. However, in this paper we will be focusing on the general toxic behavior of players displayed over textual communication, which is common in everyday gaming, and probably these extreme cases escalated from what was at one point online toxic behavior.

In his article on Cyberculture from 2015 [1], Fragoso divides toxic behavior into three kinds of behaviors: *spamming, trolling* and *griefing*. Spam (canned cooked pork) appeared in famous Monthy Python sketch in 1970, in which repetition of the word *spam* induces both redundancy and noise, making communication unviable. The term was borrowed to indicate automatic and massive sending of emails both for commercial ends and for phishing, but in online gaming it can also denote the act of doing something repeatedly and annoying their counterpart, since it's really hard to distinguish utterances of malicious intent and those without one. These actions are harmful for both the players involved, and for the developers whose servers will have to store spam data.

The second kind, *trolling,* originates from trolls in Scandinavian mythology who live underneath bridges and collect tolls from those who wish to pass. Donath [18] adds that it is a form of "baiting" by writing something in order to get a reaction and get people agitated. People engaging in trolling behavior do not gain anything, but the depraved joy of watching people being in conflict with each other. Unlike spamming, trolling doesn't bring harm to the developers directly, but indirectly does so by worsening the community reputation or bringing conflicts. The third category in online toxicity is *griefing,* causing grief, trouble and irritation to others, and making the game experience be unpleasant, painful or even traumatic [1]. According to Foo & Koivisto [19], *grief play* can also be called *greed play*, because it benefits *griefers* more than the community. This also explains why *griefing* is usually the combination of trolling and spamming, as their objectives combine.

People engaging in these toxic behaviors often hide behind the wall of anonymity that is granted by the Internet, and use derogatory words to hurt people, to sow seeds of conflict, and most of all, bring forth the negative emotions within us in what was supposed to be an entertainment tool. We conclude that this is most likely the reason why derogatory terms are used commonly in online games.

To deal with this problem, there were several additions to the gaming interface, such as colored tip or suggestion text used to calm people down, but the most notable is the introduction of the filtering system. It is implemented in the most popular game, League of Legends, detecting derogatory terms (common curse words) and replaces them with asterisks signs. However, the authors' personal experience with the filtering system found it to be ineffective, since most players will try to find a way to avoid it, simply by putting a space in-between letters or by using different lexical choices instead. In the research chapter of this thesis, we will explore such examples from our own data.

Therefore, this research paper will compare the two games of the same genre, League of Legends and DoTA2, the former having the filtering system and latter being without one. We will compare the amount of derogatory terms used in both games in the same number of sets of matches and analyze the results.

3. Methodology and goals

This research paper will compare the two popular games of the same MOBA genre, LoL and DoTA2, the former having the filtering system and latter being without one. They are similar in style and gameplay, and both very popular, with LoL ranking as 1st most played PC game in the world and DoTA2 ranked 12th [5].

We will compare the amount of derogatory terms used in both games in the same number of sets of matches and analyze the results. Even though it is likely that people in emotional situations resort to their native language [20], Naqvi, Shiv & Bechara in 2006 [21] found that most people online will use English since it's most likely the shared languages

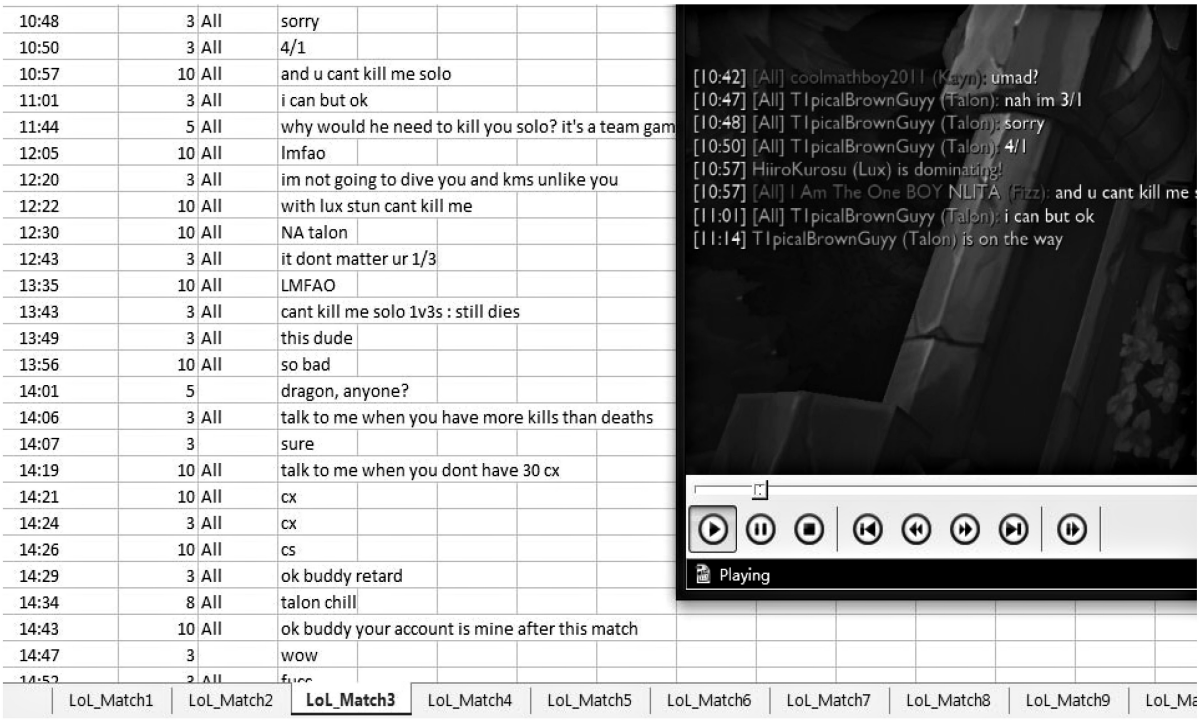

Figure 3.1: Game footage and chat transcript format

between players, and English will be the target language in our analysis.

The primary purpose of this research is to ascertain the effectiveness of the filtering system and in case of it being outdated, find an alternative solution. We will be answering the following research questions:

1. Is there any difference in a general manner of communication in the in-game chat in DoTA2 and LoL?
2. Which words are most frequently used in chat in DoTA2 and LoL?
   - What kind of derogatory terms appear within those words?
3. What kind of derogatory terms are being used in games with and without the filtering system?
   - Does the filtering system have any influence on players' choice of words?

To achieve this, we decide to do make a comparison between two games of the same genre: League of Legends, which makes use of the filtering system and Defense of the Ancient 2, which does not. By using the method of recording, transcribing and analyzing, we get our data directly, not through normal means of crowdsourcing nor Tribunal system (which we expect to be under heavy influence of human mistake, since to be reported to the Tribunal system doesn't necessarily mean being toxic to others; those who are deemed unskilled might be a target as well). We used NVIDIA GeForce Experience to record every game out of 50, with 25 matches for each game, transcribe all in-game conversation that took place into Excel files for storage and easy readability. Figure 3.1 shows the raw data in the game and transcribed data in the Excel.

From then, we converted data into text files which will be processed by the website Compleat Lexical Tutor [22] for analysis. This website provides various tools for text and corpus processing, such as descriptive statistics (word frequency, token to type ratio) and some more advanced methods such as keyword extraction.

4. Results

4.1 RQ 1: Is there any difference in a general manner of communication in the in-game chat in DoTA2 and LoL?

While the token to type ratio (e.g. the ratio of how many different words are being used) for DoTA2

is less than LoL by 2.2% and the characters count for both game are nearly the same, DoTA2 players (17,857 characters) wrote more chat text compared to LoL players (15,618 characters). Along with the difference of 2,239 characters in the same number of games, the number of chat lines (i.e. how many times a player inputted text in a separate line) in LoL is more than two times less than DoTA2 (956 and 1,934, respectively). This means that players in DoTA2 send more messages, but they are shorter compared to those in LoL. In both games, the amount of characters written by players was similar, but LoL players also use slightly wider variety of different words. In regard to the first research question, players communicate in a similar amount in both games, but not in the same manner. DoTA2 players tend to send a larger number of shorter messages and are less varied in their vocabulary.

4.2 RQ 2: Which words are most frequently used in chat in DoTA2 and LoL?

We analyzed the most frequent words in both games, and as expected we found differences both in game terms, as well as in derogatory terms. The ten most frequent words (types) are shown in Table 4.2.1. Words are represented in all capital letters in the table, but all manners of writing were counted.

When analyzing RQ1, we noticed that DoTA2 players write shorter messages but send more lines of text. They also seem to be using shorter words for greetings, such as one- or two-letter greetings which occupy the first three spots. In addition to that, they don't seem to be using any of the derogatory terms directed towards other players in the first 10 words, and we find only one expletive (WTF). There are also two expressions indicating laughter (LOL; HAHA), even though it is possible that they

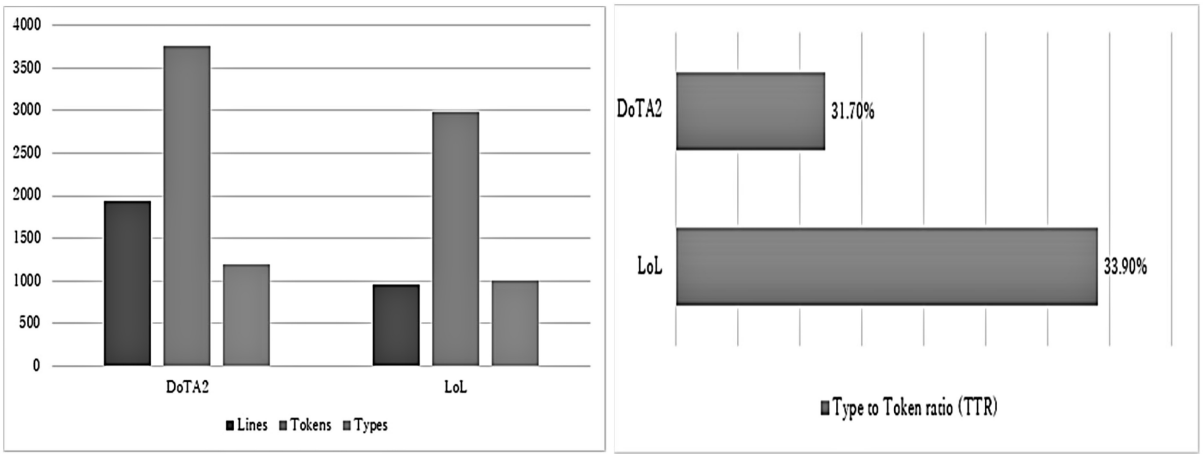

Figure 4.1.1: Difference in manner of chat in DoTA2 and LoL (tokens, types and TTR)

RANK	FREQ	COVERAGE		WORD
		individ	cumulative	
1	76	2.03%	2.03%	G
2	63	1.68%	3.71%	B
3	50	1.33%	5.04%	GG
4	50	1.33%	6.37%	GO
5	39	1.04%	9.81%	MID
6	35	0.93%	11.73%	WTF
7	31	0.83%	12.56%	NA
8	29	0.77%	14.13%	LOL
9	28	0.75%	15.65%	HAHA
10	27	0.72%	16.37%	END

RANK	FREQ	COVERAGE		WORD
		individ	cumulative	
1	44	1.48%	6.69%	GG
2	28	0.94%	14.59%	LOL
3	18	0.60%	27.27%	LIKE
4	18	0.60%	27.87%	NICE
5	15	0.50%	29.54%	BOT
6	15	0.50%	30.54%	DO
7	15	0.50%	31.04%	HAVE
8	15	0.50%	32.04%	TRASH
9	14	0.47%	32.51%	BAD
10	13	0.44%	33.39%	GO

Table 4.2.1: Most frequent words used in chat in DoTA2 (left) and LoL (right)

might have been used sarcastically[1]. Even with the given restrictions, it is obvious that DoTA2 players' vocabulary on average differs from that used by LoL players. In the case of LoL, we see less neutrality, but rather a polarized situation: there are equally many positive (LIKE; NICE) and negative words (TRASH; BAD). Players cannot use curse words because of the filtering system, but they do find a way to convey negative feelings. Overall impression is that LoL players exhibit more polarized emotions in their vocabulary choices in chat, and DoTA2 players use more neutral expressions. N-gram analysis (combinations of words that often co-occur) confirms the findings.

4.3 RQ 3: What kind of derogatory terms are being used in games with and without the filtering system?

Lastly, we focused on the derogatory terms used in both games. They were extracted by keywords method provided by LexTutor [22] and manually analyzed. Figure 4.3.1 shows selected term in both games. Number in parenthesis indicates the keyword ranking (non-derogatory keywords were removed) and the number before the keyword indicated the relative weight computed by the system.

Keywords were labeled as derogatory on the basis of Vandersmissen's [23] classification of offensive terms, but as well as the meaning nuance of the word within the game. For example, words like *herald, tilt, mute, feed* etc. can have non-derogatory meanings, but in game terminology they are used as insults. This was cross-checked and confirmed within the context in which the term was used.

First of all, we can notice that keywords in DoTA2 contain less different curse words and derogatory terms compared to LoL. Words such as *idiot, fuck* or *shit* would be censored with the help of LoL filtering system, so they do not appear in the list. That does not mean that DoTA2 players do not use curse words that much – the overall derogatory term usage does not differ significantly between the games, and players do fight and insult each other in both games. However, the word choices found in chats of LoL players show no lacking in derogatory terms, in fact we found that players use almost twice as many different derogatory terms. The words used by DoTA2 players and relatively uncreative and standard insult choices, while in LoL there seems to be more intensity in swearing.

It's quite clear that for DoTA2, with the exception of the word '*herald*' – which is an exclusive DoTA2 term used for low-skilled players, the other four are quite common curse word which can be found almost everywhere. On the other hand, in LoL, most of the words are quite creative and some of them can only be rarely found in our daily life, such as *inbreed* or *feed*. There are also instances of euphemism of derogatory words used with low frequency, although not listed above, such as 'fucc' or '.!.', supposedly it works in place of pointing a middle finger at others, symbolizing the male's genitals. These words, while low in frequency, but high in variety, can be taken as a griefers' act of resistance toward filtering system. By creating multiple distinct choices of insulting words, perhaps they plan on challenging the developer of filtering word list by growing the

DoTA2	LoL
(19) 256.50 idiot	(3) 17699.00 inbreed
(21) 192.43 fuck	(7) 1123.76 troll
(22) 164.39 herald	(8) 867.62 tilt
(40) 42.40 shit	(9) 570.94 mute
(46) 27.37 stupid	(14) 321.80 trash
	(18) 109.93 suck
	(24) 52.27 damn
	(28) 28.92 feed

Figure 4.3.1: Most frequent derogatory terms used in DoTA2 and LoL

list even longer, making it harder to filter all of derogatory words. In fact, there was a period where the LoL filtering words list were made public and even became a laughing stock online with how many ridiculous words were put in. The list has now been updated and made private, also due to the fact that many players have also been exploiting it, but the impact it has made won't soon be forgotten.

As expected, the filtering system almost doesn't change anything at all. It can even be said that it makes matters worse, considering that sometimes the curse words can be routinely used to express surprise, shock, excitement or frustration, and might not necessarily be aimed at a fellow player. It seems that LoL, while forcing players to avoid those common terms, causes them to use deliberate and sometimes convoluted derogatory terms, which in turn can result in more toxic behavior. They can even cause the words to change meaning or become pejorative. Even if the words from the keyword list are hypothetically added to the filtered words list, we surmise that the new generation of players would again find a way around it – inventing a new spelling or a different term which would convey the same negative sentiment.

5. Discussion and limitations

Since the filtering system does not seem to be, in its current form, able to successfully prevent toxicity in gaming, how can it be improved? One of the largest setbacks of the filtering system is its non-automatic update features that makes it outdated quickly. Language is ever-changing and ever-growing, so it's reasonable to match its stride by creating similarly ever-changing and ever-growing filtering system. However, while it might be possible to construct it, such a system would put a strain on the server, possibly rendering the whole system useless. Therefore, it might be ineffective or unadvisable to put it in practice. By improving the efficiency in which the data are stored and processed, it will open many possibilities on how to approach this problem.

It is also possible to address this using the social aspect. One of the main factors which encourage online toxicity is the anonymity the internet provides. The anonymity enables one to act rashly under the guise of entertainment and stress reduction. Using that logic, fixing this problem becomes feasible if we just remove the anonymity of users. For instance, limiting one person to one account might help, since people will start to think twice before committing any act of toxicity. Of course, this method is not without drawbacks, since it will remove a portion of the freedom that internet provides, and might hurt the developers economically. In the long term, it is probably advisable to invest in the education of young players about their behavior online, and to teach values that would deter players from hurtful behavior by their own will, not by restrictions or forceful implementation of the rules.

On the last note, it is important to mention that this study is limited in several ways: (1) written chats in the game and not spoken chat, (2) there was no detailed context analysis, such as differences between teams and reactions to certain game events, and (3) there is no demographic information about the players. However, even within these limitations, we believe that the results strongly suggest that restriction of free speech is a reactive method and not a solution to the problem of toxic behavior in gaming.

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[1] For the purpose of this paper, we did not perform context and discourse analysis, but rather a quantitative overview of the chats corpus.