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Conflict and Communication in Massively-Multiplayer Online Games

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Abstract. Massively-multiplayer online games (MMOGs) can serve as a laboratory for studying large-scale human behaviors. However, one question that often arises is whether the observed behavior is specific to the game world and its winning conditions. This paper studies the nature of conflict and communication across two game worlds that have different game objectives. We compare and contrast the structure of attack networks with trade and communication networks. Similar to real-life, social structures play a significant role in the likelihood of inter-player conflict.

Keywords: attack networks; social network analysis; massively multiplayer online games

1 Introduction

Most online social media platforms are optimized to support a limited range of social interactions, primarily focusing on communication and information sharing. Services can be specialized by the type of information (video, blogs, or photos) or by the context (personal vs. professional). These online exchanges serve to reinforce real-life relationships or to provide an archival, "curated" view of people's life experiences. In contrast, relations in massively-multiplayer online games (MMOGs) are often formed during the course of gameplay and evolve as the game progresses. The amount and richness of social intercourse makes it possible to observe a broader gamut of human experiences within MMOGs, such as World of Warcraft, Sony EverQuest II, and Travian, than can be done with other data sources.

In particular, inter-player aggression is more openly expressed within MMOGs since combat often comprises a large portion of gameplay. This paper studies how conflict in MMOGs shapes the underlying social networks. On other social platforms, heckling and "griefing" behavior is largely performed by individuals, rather than groups, and is often the province of individual "trolls" who sow discord. In MMOGs, conflict and cooperation are inextricably linked since many attacks are launched by coalitions of players to gain resources, control territory, or subjugate enemies. For this paper we extract and analyze dynamic multiplex

networks from two MMOGs (Travian and GameX), with separate link types to denote attacks, communication, and trade; rather than studying a single network snapshot, we study the network evolution over a longer game period.

MMOG behavior is somewhat unique in occupying a middle-ground. Much online behavior can be considered "light weight" – of little consequence. Clicking on ads, reading a news article, etc. often do not have much consequence on one's life. In contrast, behaviors in the real world, such as purchasing a car, have significant economic and social impacts, and are thus take place under more scrutiny.

Behavior in MMOG's occupies a middle ground. The length of time players put into cultivating and creating their character can be immense (some players put more than 22 hours a week into playing their MMOG!). This means that they may not foolishly risk their characters well-being. On the other hand, conflict in game do not have any physical repercussions on players, so there are fewer cautions than in the real world to engaging in conflict. Because of these considerations we view behaviors in MMOG's as being of "middle-weight".

The overarching aim of our study is to understand the evolution of conflict in different game worlds. First, we analyze how communication, trade, and geographic connections affect the likelihood of two players' engaging in hostilities. Then we study how attack networks differ from communication networks; our hypothesis is that since attack networks are created by non-collaborative social processes their network statistics will differ from communication networks that are formed from dyadic closure and preferential attachment. Finally, we discuss how differences in MMOG game objectives shape the structure of conflict.

2 Related Work

The related work falls into the following categories.

- trust in MMOGs
- nature of conflict
- Travian studies
- comparison studies in MMOGs

3 Objectives

MMOGs serve as unprecedented tools to theorize and empirically model the social and behavioral dynamics of individuals, groups, and networks within large communities. Our aim in this research is to compare the nature of two online multiplayer games (Game X and Travian) and study their similarities and differences. Little existing work compares multiple games together. Travian and Game X have many similarities and some significant differences. Understanding which aspects of human behavior stay the same in both games will provide insight on underlying facets of human behavior that may be generalizable to human groups in general.

Having data from two MMOGs, we would like to study the underlying structure of conflicts and communications in this type of network.

Hence, first we describe both games and data collected for them briefly. Next, similarities and differences between the two games are studied statistically and based on their gaming features. Finally, results from experiments regarding our research hypothesis will be described.

4 Datasets

We used two datasets from two different, browser based games: Travian and Game X. For Game X we have 730 days of player data, and from Travian we have 3.5 months. Travian has a fixed cycle – a game starts and ends when certain conditions are met. Game X is open ended and does not have any explicit winning conditions.

4.1 Game X

Game X is a browser-based exploration game which has players acting as adventurers owning a vehicle and traveling around a fictional game world. There is no winning in Game X, rather players freely explore the game world and can mine resources, trade, and conduct war. There is the concept of money within Game X, which we refer to as marks. To buy vehicles and travel in the game world players must gather marks. There is a vibrant market-based economy within Game X.

Players can communicate with each other through in-game personal messages, public forum posts and in chat rooms. Players can also denote other players as friends or as hostiles. Players can take different actions, such as:

1. Move vehicle
2. Mine resources
3. Buy/sell resources
4. Build vehicles, products, factory outlets
5. Fight Non-Player Characters (NPCs)
6. Fight other players

Players can use resources to build factory outlets and create products that can be sold to other players. Unlike other MMO's like World of Warcraft (WoW) and Everquest (EV), Game X applies a "turn system". Every day each player gets an allotment of "turns". Every action (except communication) requires some number of turns to execute. For instance, if a player wants to move their vehicle by two tiles, this would cost, say, 10 turns. Turns can be considered a form of "energy" that players have.

The use of turns has two major impacts:

1. Players with varying time commitments can play together. Since everyone is limited to the same amount of actions per day players with minimal time

	Nation	**Agency**	**Guild**	**Race**
Number:	Fixed, 3	Fixed, 2	Dynamic, Many	Fixed
Membership type	Open	Open (req's)	Closed	Open
Modifiable	Yes	Yes	Yes	No

Table 1: Summary of properties of the groups in Game X

on their hands are less disadvantaged than in other games. In contrast, in WoW player leveling and experience can depend highly on the amount of time they play (e.g., "grinding").
2. Players have to think about their moves ahead of time. Because there is a limit on turns, players must think and plan ahead before making their moves.

Players move from tile to tile in their vehicles. Tiles can contain resources and/or factory outlets and market centers. Only one factory outlet/market center may exist on a tile. The world is 2D, and does not wrap around.

Players can gather resources from tiles and sell them to market centers. Factory outlets allow the creation of new goods from resources e.g., producing steel from iron ore. More advanced factory outlets exist which can create more advanced objects, e.g., taking steel and producing a sword. Gathering resources and selling to factory outlets is the main way of gaining marks in Game X.

Factory outlets and market centers can be built by players. Creating these structures is relatively straightforward and does not take much in terms of marks or experience. The difficulty lies in maintaining the structures. In order to prosper, the structures require certain resources. Once built, supplying your structures with the necessary resources can be time consuming. Joining a guild (see below) can be helpful as members of the guild can supply your structure.

Players can also engage in combat with non player characters, other players, and even market centers and factory outlets. Players can modify their vehicles to include new weaponry and defensive elements. Players have "skills" that can impact their ability to attack/defend.

4.1.1 Groups in Game X There are four types of groups a player may belong to. Table 1 summarizes the properties of these.

Nations

There are three nations a player may join. We label them A,B, and C. A player may choose not to join a nation as well. Nations are fixed and defined by the game creators. Nation membership is open, players may join any nation they wish at any time and leave at any time. Joining a nation provides several benefits:

1. Access to restricted, "nation controlled" areas.
2. Access to special quests.
3. Access to special vehicles and add-ons.

Nations have different strengths; one nation may be better suited for weaponry, and thus have more weaponry related add-ons. Another may be suited for trading. Completing quests for a nation increases a player stature towards the nation which leads to access to special vehicles and add-ons. Wars occur between nations.

Agency

An agency can be thought of as a social category. There are two agencies, X and Y. A player can only be a part of 1 agency at any time. To gain membership to an agency certain requirements need to be met, but if those are met anyone can join the agency. Certain vehicles are open to particular agencies.

Race

Player may chose their race when they create a character. Different races have strengths in certain areas, implemented as different initial levels of skill. Race is fixed and cannot be changed once chosen. Race also determines starting location. Race does not seem to play a strong role in the dynamics of the game.

Guild

Game X also allows the creation of player led guilds. These guilds allow members to cooperate to gain physical and economic control of the game world. Guilds are comprised of a leader and board who form policy and make decisions that impact the entire guild membership.

Guilds can be created by any player once they have met experience and financial requirements. Guilds have a minimum membership of 1, and no upper limit on size. Apart from the officers, there are the "privileged guild members" a special set of guild players who are considered important. Finally there are the regular guild members. Guilds are closed-players must submit an application and can be denied membership. Guild members have access to private communication channels. Guilds have a "guild account"which can store marks from players (taken in the form of taxes). These marks can be redistributed at the will of the CFO.

4.1.2 Communication in Game X

Game X includes 3 methods by which players can communicate with each other:

1. Personal Messages: An email like system for communicating with other players, or in some cases groups of players.
2. Public Forum: A Usenet like system in which players can post topics and replies (see below).
3. Chat: An IMlike system for players to chat with others in their guild.

Each forum post includes the name of the player who posted an image of their avatar in the game, and their guild affiliation.

4.2 Combat Activities

Players can engage in combat with other players (real and artificial), as well as with factory outlets and market centers. Players can outfit their vehicles with

a variety of different weapons and defensive armors that (alongside a player's skill) can be used to give certain advantages in battle.

Players have an array of skills they can improve based upon their successful in game battles. Higher skill values increase the probability of successful combat in the future.

4.3 Potential for Large Scale Conflict

Large Scale Conflicts (i.e. wars) are social and very related to combat activities. Wars are only possible between the three pre-defined nations. Each nation can have one of the following diplomatic relations to all others: Benign, Neutral, Strained, or Hostile.

The senior members of a nation constitute the nation's governing body. Every day, each nation's governing body convenes and each of the senior members chooses a disposition with regards to diplomatic relations with the other nations. Non-senior members cannot vote, but can exert influence by lobbying senior members to vote a certain way. If enough members of a governing body select hostile diplomatic relations against another nation, a war is declared between the respective nations. When a war has broken out, additional combat actions are available for the warring nations.

In particular, war quests are available, which provide medals of valor to the players that wish to undertake and complete the quests. Any attack against the opposing nation (be it in the form of a war quest or not) results in accumulating a set number of war points. When the war ends, these war points determine the "winner" of the large-scale conflict. A war situation will (via the game's design) gravitate towards a state of peace. Each of the respective governing bodies must maintain a majority vote to continue the war effort. Over time, the amount of votes required to continue is increased by the game itself. Eventually, no amount of votes will suffice and the nations return to a state of peace.

Players also have a bidirectional "reputation" measure with the nations in the game. Combat with members of other nations incurs a negative penalty to this measure. During the war period this negative penalty is dropped for players of the two warring nations – allowing unrestricted combat.

4.4 A Player's Death

A player cannot permanently die in Game X. If an enemy destroys a player's vehicle, then the player loses a fixed amount of skill points, as well as all the cargo on his or her vehicle and in addition loses some available actions for the play session.

4.5 Travian

The MMOG Travian is a browser-based online game with more than 3.3 million users playing at the beginning of 2008. The game itself is a real-time strategy

game (RTS) and it is timed to last approximately three and a half months. Players start out as chieftains of their own villages having chosen to be a member of one of three tribes: Gaul, Roman, or Teuton. Each of these three tribes has its own advantages and disadvantages. For example, Gauls are best at living in peace, have the fastest merchants and the fastest units in the game, are best on defense and concealing resources from raiders, and are the only tribe to be able to build a trapper; Teutons produce the cheapest military units and are the best raiders; Romans alone can simultaneously build buildings and extend resource areas. The objective is to extend the productive capacity of resource areas and construct suitable buildings and military units so as to expand by colonization and/or conquest and eventually be the first to finish building one of the World Wonders.

Each server is a closed game environment and holds a maximum of approximately 25,000 users. On a single server with scarce resources, players soon find themselves in a social dilemma [1], which is typical for organizations, project teams and economies where parties need to both coordinate and compete with one another. In the race to dominate, actors form teams or "alliances" of up to 60 members under a leader or a leadership team. Teams are equipped with a shared forum, a chat room and an in-game messaging system. As in the real world, teamwork and negotiation skills play a crucial role in this context. Given these characteristics, Travian affords an excellent opportunity to study various facets of virtual conflicts, cooperations and communications.

Conflicts in Travian can be divided into two categories: attacks and raids. Attacks and raids are very similar but serve different purposes; an attack is meant to destroy its target, whereas raids are meant strictly to gather bounty, and are much less vicious. In a raid, the armies will do battle until at least one side is reduced in strength by 50%. Because of the nature of raids, they take place in the game more often and hence we use the data collected for the raids to create the attack network.

Besides conflicts, the game provides several mechanisms for player interaction, including a messaging system that allows instantaneous interaction. We were provided with the game data for messages and trades, and extracted the information needed for our experiments from these. In Travian, villages may trade their resources with other villages if both villages have a marketplace. A trade is an exchange of different resources (gold, wood, clay, wheat) necessary to upgrade a village's buildings. On the other hand, in-game messages, often abbreviated to IGMs, are the primary messaging system offered by Travian which is vital for in-game communication with other players. IGMs can also include broadcast messages, i.e. messages sent to all players by the game moderators. However, in this analysis, broadcast messages were not considered as the volume could introduce bias in the results.

5 Travian vs. Game X

In order to further examine the conflicts and cooperation structures in MMOGs, we compare the network statistics and opportunities for cooperation and competition in Travian and Game X. For each game, we focus on three types of networks: attacks, trades and messages.

5.1 Comparison

As mentioned before, the Game X dataset consists of the data from 730 days and Travian data is from approximately a three and a half month period. There are many factors that affect network parameters over these periods. In order to capture conflict and cooperation structures in the two games, we decided to study a specific period from each game and compare the two with each other. For Travian, a 30 day period is selected from the middle of the game duration. This is to avoid focusing on players who might leave the game in the early days due to the lack of interest in playing it and also stay away from the last month of the game in which players tend to attacks more often in order to collect enough resources to finish building the Wonder of the World and win the game.

Table 2: Set of features used to compare days from Travian and Game X

Features	# of nodes, # of edges, Avg. path length, Diameter, Avg. degree, Local transitivity, Global transitivity

We compared this 30 day period from Travian with the Game X dataset to pick the best matching days between the two. To do so, a vector of features was created for each day of the two games. Then we find the most similar day from Game X using an Euclidean distance measure. Table 2 shows the set of features used to calculate the distance. Results of this comparison show that the 30 day period between ([590,620]) matches the data from Travian.

This can be explained by the fact that this period is primarily when the second war occurred in Game X (shown in Figure 1) and since attacks happen more frequently in Travian, they better match with each other. Thus, the second war period of Game X (which actually is from day 587 to day 632), was selected to do all further comparisons between the two games.

6 Comparison Studies

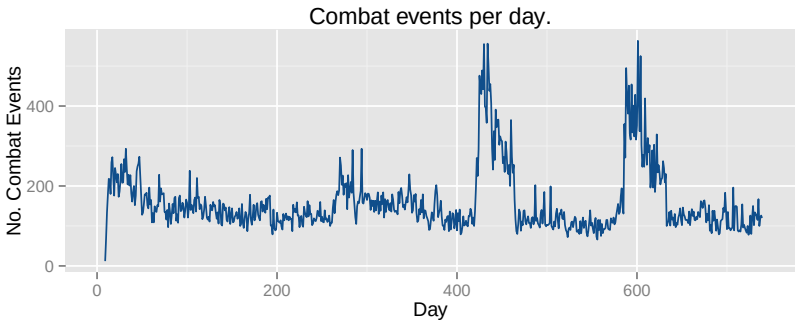
The first comparison we ran was to verify that the degree distributions on the attacks, messages and trades are distributed according to power law distribution.

Table 3: Travian attacks, messages and trades networks parameters

Parameters	Attacks	Messages	Trades
# of Vertices	4418	3092	2649
# of Edges	35335	45116	86961
Diameter	17	9	10
Avg. Path Length	5.312	3.471	2.849
Avg. Degree	7.998	14.591	32.828
Avg. Clustering Coefficient	0.065	0.319	0.154

Table 4: Game X attacks, messages and trades networks parameters

Parameters	Attacks	Messages	Trades
# of Vertices	5112	2898	5860
# of Edges	70662	12136	5713
Diameter	14	8	10
Avg. Path Length	4.476	3.402	4.218
Avg. Degree	8.375	27.645	25.01
Avg. Clustering Coefficient	0.012	0.137	0.117



(a)

Fig. 1: Frequency of attacks during 730 day period of Game X

Clauset et al.[2] proposed a robust maximum likelihood technique for estimating the parameters of a power law. We ran the experiment on both Travian and Game X for the three networks. The results in Figure **??** show that both Game X and Travian exhibit power law degree distributions.

Although the two games have a lot in common there are several differences which are worth pointing out. The most important difference between the two games is in the nature of attacks. In Travian, attacking is more frequent and known to be a popular action in order to gain resource. Unlike Travian, in Game

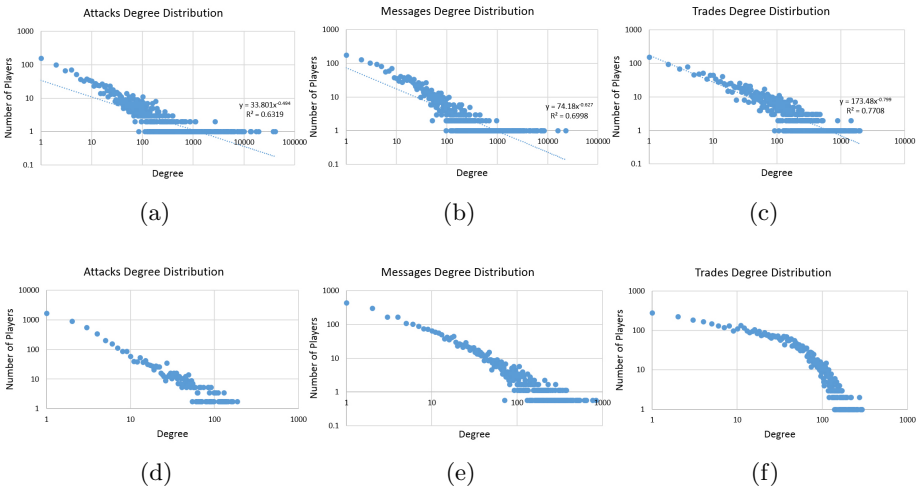


Fig. 2: Log-log figures for degree distribution in attacks, messages and trades networks from Travian (a) Attacks network degree distribution (b) Messages network degree distribution (c) Trades network degree distribution and Game X (d) Attacks network degree distribution (e) Messages network degree distribution (f) Trades network degree distribution

X, attack have limitations and side effects, i.e. a loss of reputation. Also, Game X has a turn base limitation, which means users can not be logged in to the system all the time and they have to stick to their terms. These limitations and side effects, can cause Game X to have less frequency in terms of attacks.

6.1 Experiments

This section discusses the results of a series of studies we have conducted in order to analyze the conflict structure observed in MMOGs. These experiments were conducted to answer the following research questions:

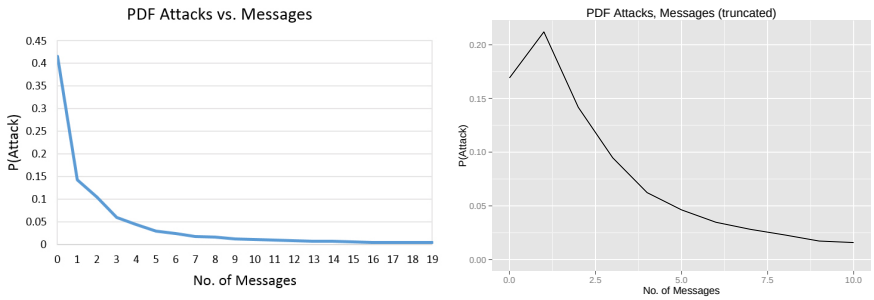
Attacks vs. Messages

In Travian, according to Figure 3 (a), in 41% of cases, users have not attacked other players with whom they have been in contact at least once. Also, it is worth mentioning that the attacks vs. messages data follows a power law distribution. The more players communicate with each other the less probable it becomes for them to attack each other.

On the other hand in Game X, as shown in Figure 3 (b), the above statement stands only for 17% of attacks. Instead, 22% of attacks have occurred between players with one message exchanged.

Attacks vs. Trades

As expected, in Travian a large number of players do not attack others with which they have traded resources. Based on Figure 4 (a), 28% of attacks that

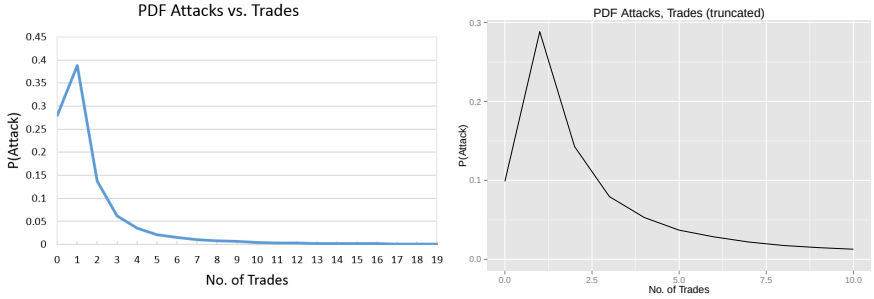


(a) (b)

Fig. 3: (a) Probability of attacks occurred between a pair of users vs the number of messages they have exchanged in Travian (P(Attack and Message=x)). (b) P(Attack and Message=x) in Game X

occurred in Travian were between two players without any trading history. However, this rate is surprisingly low in Game X; only 10% of attacks follow the same rule as shown in Figure 4 (b).

Also, as shown in Figure 4, there is an increase in the attack probability when the number of messages is 1 (P(Attack and No. Messages=1)).

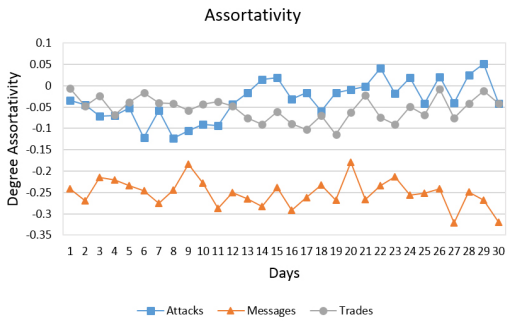


(a) (b)

Fig. 4: (a) Probability of attacks occurred between a pair of users vs the number of messages they have exchanged in Travian (P(Attack and Message=x)). (b) P(Attack and Message=x) in Game X

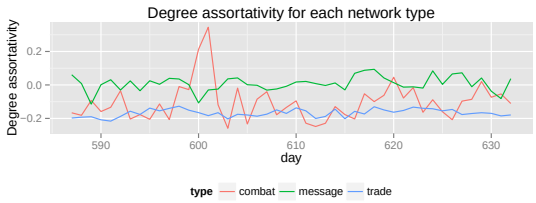
Same alliance or guild attacks

In Travian, 4% of the attacks edges are between two players within the same alliance. Surprisingly, the same rate stands for Game X and only 4% of players attack their guild-mates.



(a)

Fig. 5: Travian nodes degree assortativity



(a)

Fig. 6: Game X nodes degree assortativity

Networks assortativity

Assortativity is a preference for a network's nodes to attach to others that are similar in some way. Though the specific measure of similarity may vary, network theorists often examine assortativity in terms of a node's degree[3]. Correlations between nodes of similar degree are often found in the mixing patterns of many observable networks. For instance, in social networks, highly connected nodes tend to be connected with other high degree nodes. This tendency is referred to as assortative mixing, or assortativity. On the other hand, technological and biological networks typically show disassortative mixing, or dissortativity, as high degree nodes tend to attach to low degree nodes[4].

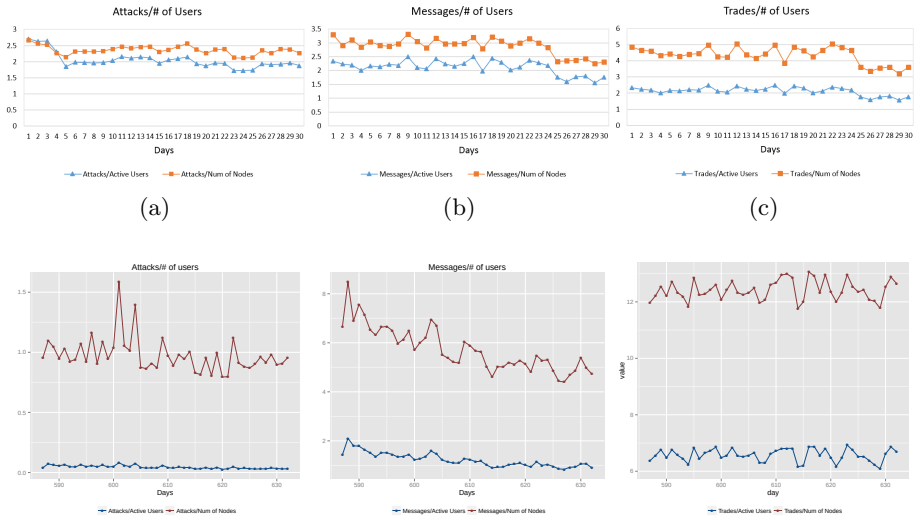
For this experiment, node degree was used to calculate assortativity for the Travian and Game X networks. For Travian, as shown in Figure 5, messages networks show disassortative mixing while attack and trade networks tend to show a non-assortative mixing. This suggests that players who send more messages are in contact with others who rarely send messages. This can be explained by the fact that some of the users are leaders in alliances, and they send messages to others more frequently. On the other hand, trade and attacks being non-assortative may be because a) It has almost equal assortative and disassor-

tative links with equal strength on average b) It has more assortative links, but disassortative links are on average stronger or c) It has more disassortative links, but assortative links are on average stronger[5].

For Game X, however, attacks and trades networks show a disassortative mixing while messages network have a non-assortative mixing. This important difference between the two games can be explained by the fundamental difference in the two games dynamics.

Activities based on number of users

The last experiment describes the frequency of activities based on the number of users being active during a specific game day. Figure 7, shows results for three types of activities: attacks, messages and trades. To calculate average number of activities done by users, we have considered both numbers of active users and number of edges in the network. According to our findings, attacking is the most popular activity in Travian. Users log in to the game on a daily basis, not only to check the status of their villages, but also to gain more resources in order to update their building. Messaging is the second popular activity in Travian, while trading is the last one in this list.



(a) (b) (c)

(d) (e) (f)

Fig. 7: Attacks, Messages and Trades per active users and nodes in daily snapshots from Travian (a) Attacks (b) Messages (c) Trades, and Game X: (d), (e), and (f)

Game X exhibits a much higher proportion of trades, which is due to the structure of the game.

7 Conclusion and Future Work

This paper summarizes our findings across two massively multiplayer games, Game X and Travian, with different in-game objectives.

8 Acknowledgments

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