Guild Play in MMOGs: Rethinking Common Group Dynamics Models

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Abstract. Humans form groups and congregate into groups for a variety of reasons and in a variety of contexts e.g., corporations in offline space and guilds in Massively Multiplayer Online Games (MMOGs). In recent years a number of models of group formation have been proposed. One such model is Johnson et al's [10] model of group evolution. The model is motivated by commonalities observed in evolution of street gangs in Los Angeles and guilds in an MMOG (World of Warcraft). In this paper we first apply their model to guilds in another MMOG (EQ2)[1] and found results inconsistent from the model's predictions, additionally we found support for the role of homophily in guild formation, which was ruled out in previous results, Alternatively, we explore alternative models for guild formation and evolution in MMOGs by modifying earlier models to account for the existence of previous relationships between people.

Keywords: Guilds, MMOGs, Groups, Models of group evolution.

1 Introduction

How humans form groups and how these groups evolve over time has a long history of research [6,8,15]. Large-scale study of group formation has been limited because of the unavailability of data. With the advent of the internet and online systems where millions of people can simultaneously interact with one another in virtual communities and virtual worlds, the data are no longer an obstacle. It is now possible to analyze human behavior and group formation in much more detail and at vast scales. Researchers have argued that given the complex and interdependent nature of interaction and behavior in MMOGs, they are often sufficiently similar to the "real world" for us to gain important insights about the social [21], behavioral [11,16] and economic [5] aspects of the real world, a scientific analysis known as "mapping"[17]. Guilds are formal organizations of players in MMOGs, and are ideal to study the

[1]http://www.everquest2.com/

formation and evolution of human groups because they parallel existing, well-known and studied groups such as work teams and friendship networks guilds [18].

Johnson et al [10] posited a model of evolution of groups and applied it to both guilds in World of Warcraft (WoW) and street gangs in Los Angeles. They discovered that the same model can be used to describe how guilds and street gangs in Los Angeles evolve over time. Their model was based on the idea that the driving force in their evolution is the tendency to maximize the diversity of skillsets in the group. They also showed that a variation of their model based on homophily cannot reproduce the behavior of these groups over time and thus homophily can be ruled out as an explanation for the formation and evolution of these groups. In this paper we apply Johnson et al's model and its homophily based variation and apply it to data from another MMOG called EverQuest II (EQ2). Given that WoW and EQ2 are sufficiently similar and the results of Johnson et al's model are applicable to two very different domains, the model should be applicable to the EQ2 dataset. However we find that the results that we obtain in EQ2 are divergent from what was reported previously, namely we observe that homophily based models can also explain the evolution and formation of guilds. This is in contrast to the previously reported results which found strong evidence against homophily as an explanatory factor in guild evolution. Based on these results we propose a new model of group evolution which is obtained by modifying the team formation model and introducing the element of prior relationships between them.

2 Related Work

There is a growing body of research on MMOGs and there many studies on the multiple aspects of socialization [3] that highlight the importance of grouping and guilds. Previous work in MMOGs reveal that the size of the groups affects the aggregate behavior or the groups [20], multiple types of interactions in MMOGs [2] and that task-oriented group formation depends upon common challenge-orientated nature of its participants [9]. Keegan et al [4] also analyzed the trade networks of gold farmers and social networks of drug dealers and found out that gold farmer networks are most similar to drug dealer. Previous work on guilds includes looking at factors that make them successful [10,18]. Thurau et al [12] examined the evolution of social groups in World of Warcraft (WoW). Additionally, virtual worlds provide a venue for analyzing social phenomenon and networks in levels of granularity where it was not possible to do so previously, and may reveal surprising results e.g., mentoring networks [1] in MMOGs are different from most other social networks.

3 Guilds in MMOGs

A guild is a formal and relatively stable organization supported by the code of an online game. Guilds can range in size from several players to a couple hundred or even more. Players can belong to only one guild but are allowed to quit one guild and join another. Like many other MMOGs on the market, EQ2 provides built-in functionalities to assist guild formation and management. All guild members carry a "tag" on their character name identifying their guild affiliation. Guilds have access to a private chat channel dedicated to facilitate communication among guild members, as well as "messages of the day" that all members would receive automatically upon logging in. Other features include a specific guild window showing a guild roster, individual and guild events, the guild bank logs, guild leadership, among others. Guilds form so that members have an easy way to play together and a common identity. Each guild has a guild master analogous to a company president, and a hierarchy of players analogous to military or corporate forms. People join guilds for a variety of reasons, but typically for access to resources and knowledge, for social support, and to avoid playing with more anonymous strangers [18]. As a result, guilds in MMOGs offer an excellent venue to study organizational behavior. While a number of papers have been written about guilds in MMOGs these studies suffer from the following deficiencies:

- Almost all the previous studies use data from one MMOG namely World of Warcraft. While some researchers think that [10,18] the results of these studies may be generalizable, this is an empirical question and until results are replicated in other MMOGs generalizations cannot be really made.
- Most of the studies on MMOGs take a static snapshot of the data and thus there have not been many longitudinal studies, with some exceptions [10].
- Most papers like Johnson et al [10] analyze guild data at the character level but not at the account level. They state that even though players may have multiple characters associated with them, they usually play with one of the characters. While the assumption that the results would be generalizable at the level of accounts, we think that this question should be empirically addressed.

4 Models of Guild Formation

Homophily has been described as an important factor in bringing groups together [13]. Prior bonds can also serve as a strong basis for the formation of bonds [9]. We first describe the group formation models of Johnson et al [10] before describing the results of that model on our dataset. The Johnson et al model consists of n agents. Given an agent i, it is randomly assigned attribute parameters p_i and Δp_i such that the Δp_i describes how much parameter p_i can vary. Both of these attributes are sampled from a Gaussian distribution with a mean $<p_i>$ and standard deviation $\sigma_{\Delta p}$. Associated with each agent is a tolerance value τ. The parameter p_i is an abstract representation of a person's attributes, and homophily is defined with respect to similarity in this attribute. The simulation starts with each agent being part of a "group" and at each time step an agent is picked at random and has to decide to stay with her current group, join a new group or merger groups based on certain pre-defined criteria. The following scenarios are possible:

(i) Joining a Guild: If the agent is not part of any guild and has to decide in joining a guild then the agent considers the average attribute of the guild $P_J = \frac{1}{N_J}\sum_{k \in J} p_k$ and decides to join the guild if its attributes are sufficiently different from the attributes of the guild *i.e.,* if the following condition is met $|p_i - P_J| > \Delta p_i$. Since not only the player but the guild has to consent for the player to join then the attributes of the individual members of the guild are also compared with that of the applicant to the guild. The person is admitted if her attributes are sufficiently different. Thus consider the function *f* which measures the range of attributes covered by the applicant as compared to the rest of the guild.

$$F_{i,J} = \frac{1}{n}\sum_{j\in J} \theta\left(\Delta p_i - \left|p_j - p_i\right|\right)$$

Where *J* = guild under consideration, $\theta(x) = 1$ for $x > 0$ and $\theta(x) = 0$ otherwise. The new person is acceptable to the guild if the value of the function *f* is less than the average tolerance τ_J of the guild.

(ii) Leaving a Guild: A person can decide to leave a guild if the person is already part of the guild but realizes that its abilities are sufficiently similar to the rest of the guild members and thus decides to leave. This is measured by the fraction of guild members with similar attribute ranges as follows:

$$f_i = \frac{1}{n_I}\sum_{K\in I(k\neq i)} \theta(\Delta p_i - |p_k - p_i|)$$

If $f_i < \tau_i$ then the agent leaves the guild.

(iii) Switching Guilds: Even if an agent finds a guild tolerable she can still switch guilds if she finds a more suitable guild. Thus in this case another agent *j* is selected at random and the characteristics of guild *J* of agent *j* are considered. The agent switches guilds if the following two criteria are met: $|p_i - P_J| > |p_i - P_I|$ and $f_{i,J} < \tau_j$.

(iv) Guild Mergers: If nothing happens in the previous two steps then a merger of the two guilds is considered. Guild *I* to which agent *i* belongs merges with guild *J* to which the agent *j* belongs if the following condition is satisfied. $|P_I - P_J| > \Delta P_I$, where $\Delta P_I = \frac{1}{n}\sum_{i\in I} \Delta p_i$. Guild J considers merging with guild I if $|P_J - P_I| > \Delta P_J$.

The goal of the model is to describe a minimal model of group evolution which can replicate the global characteristics of group size over time. Thus given guild sizes IN WoW and also sizes of street gangs in Los Angeles, the authors describe how well the models replicate group sizes over time. The authors explore two different but related models for group formation. The first model which we just described, the Self-Organized Group Formation model, can readily be modified to obtain the second model called the Kinship model by flipping the inequalities in equations above. This leads to scenarios where e.g., instead of joining a group because of maximum differences in abilities, an agent joins a group because of minimum difference, hence because of homophily. The results of the simulations indicated that the self-organized group formation model performs better than the kinship based model as it gives much better fit to guild sizes which are actually observed in the data.

5 Criticism and Alternative Models

While Johnson et al's model can replicate some features of group evolution in two different datasets over time; there are a number of other areas where it falls short. First we note that the comparison of the kinship model with the given model parameters does not map well, at least in the MMOG setting, because the game mechanics of MMOGs incentivize class diversity rather than uniformity in groups. Additionally the manner in which kinship and homophily is described greatly affects how the simulations are set up and consequently what type of results one obtains e.g., in the Johnson et al. model homophily is defined unidimentionally, in terms of similarities in abilities. There are other dimensions of homophily e.g., in terms of demographics, game play etc. Whereas offline there is a kin-based benefit to homophily with roots in evolutionary biology [19], similarity online is not about genes or identity. Instead, in a game scenario pure similarity is a strategic liability. For example, a group of all healers or all wizards doesn't perform as well as a mixed group [14]. Consequently their model is not sufficient in refuting the kinship hypothesis of group and guild formation.

Secondly, the authors state that since different parameter values are obtained for different ethnic groups in gang memberships and servers that fit the data, thus servers are analogous to ethnicities. However this conclusion is not warranted since different servers usually represent different types of game play where either the goals or the rules of the game are slightly different, thus creating varying social dynamics [18]. Equating these to ethnic groups does not fit. The attraction to different rule sets is thought to be based on personality [21], and so unlikely to be driven by the same factors that lead to ethnic grouping. Thirdly, they only initialize their simulations at the character level. Players in MMOGs typically maintain one account but often create multiple characters. The authors state that it can be safely assumed that in general players play the game with only one of their characters for the time period where the data was taken [10]. This is an assumption which can only be checked with access to the back-end data where characters are joined to the accounts. Such data are included in the present analysis.

Based on these observations, we use the models proposed by Johnson et al. to replicate the distribution of guild sizes in another MMOG, EverQuest II. We note that in terms of nature of play and the setting of the game, it is quite similar to World of Warcraft which was used in the original experiments by them. In additional to replicating the experiments based on the models given by Johnson et al., we also formulate new variations of their models based on the observations regarding the social networks of the players in MMOGs. We note that players in MMOGs form social relations for a variety of reasons and in a variety of contexts [9]. Thus consider the process of guild formation, guilds form either around existing social ties or facilitate the formation of new social ties. Thus we consider scenarios where a person's decision to join a guild is directly dependent upon the existence of social ties that may already be present.

(i) Joining a guild: Consider the case when the agent has to decide if she wants to join a group, she will compare her abilities with the rest of the guild. $P_J = \frac{1}{N_J}\sum_{k\in J} p_k - \frac{\alpha}{N_J}$ where α is a variable that captures the amount of socialization of the agent with respect to the other agents in the network. Thus

$$\alpha_i = \frac{\sum_{j\in J} \mu_i(j)}{\sum_{k\in K} \mu_i(k)}$$

where the function $\mu_i(j)$ defines the number of interactions that the agent i has with agent j. The set J is the set of all members of the guild under consideration and the set K is the set of all agents that agent i has interacted with. This quantity is the relative

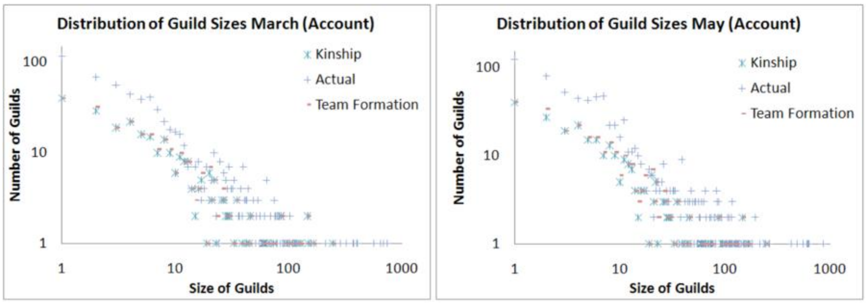

Figure 1 and 2: Distribution of Guild Sizes when the data from March (account level) and May (account level) is taken as the seed respectively

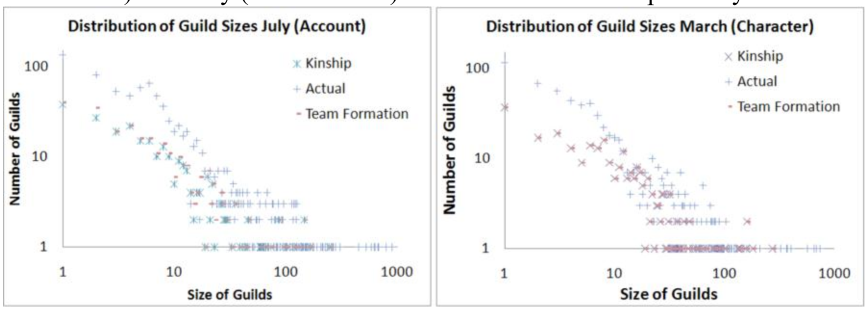

Figure 3 and 4: Distribution of Guild Sizes at the account level when the data from July (account level) and March (character level) is taken as the seed respectively

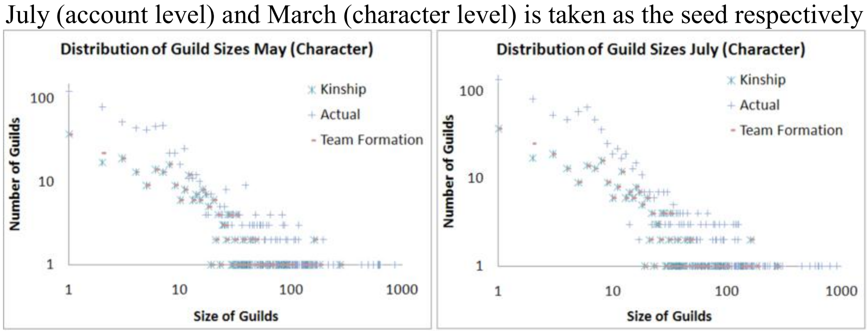

Figure 5 and 6: Distribution of Guild Sizes at the account level when the data from May (account level) and July (character level) is taken as the seed respectively

measure of the socialization of the agent *i* with members of the guild *J*. The same condition still holds for joining a guild *i.e.*, if $|p_i-P_J| > \Delta p_i$ holds. The tolerance of the agents is modified based on amount of socialization i.e., $\tau_i = \tau_i * (1- \alpha_i)$.

(ii) Leaving a Guild: The agent decides to leave the guild in an analogous manner with the tolerance being defined in the same modified manner as in the previous step.

(iii) Switching Guilds: The same scheme is used for switching guilds as in the previous case but with the difference that the formula for the preference is modified to compensate for the socialization factor of the agent i.e., the factor α.

(iv) Guild Mergers: In case of guild mergers we modify the tolerance of the guild based on commonality of socialization between the two guilds. Thus consider guild *I* and guild *J* from the previous examples, the tolerance of a guild is defined as follows:

$$\alpha_I = \frac{|I \cap J|}{|I \cup J|}$$

Which is the Jaccard's coefficient, the tolerance of the guild can thus be defined as follows $\tau_I = \tau_I * (1- \alpha_I)$. Thus the proposed model retains the features of the original model with the emphasis on a minimalist model but it introduces the idea of social interactions in the model to determine how guilds grow over time based on the social network of the agents who participate in the group.

6 Experiments and Simulations

The data from EQ2 spans from January 1, 2006 to September 4, 2006. The dataset has a total of 2,122,612 characters and 675,281 unique accounts. Each account therefore has a little more than 3 characters attached to it on average, suggesting a difference from assumptions made by Johnson et al. Not all the players are however part of a guild. We use data from one of the servers (Guk) where 45,800 players are observed, only 13,115 were part of a guild *i.e.,* only 28.67 percent of all the players. Depending upon the variables of interest we do some of our analysis at the account level and some analysis at the character level. We also note that the data is already anonymized so that it is not possible to link accounts in the game to real world people and thus the privacy of the players is preserved.

We first describe the results for replicating Johnson et al.'s model in EQ2 dataset and then the results for the modified model. We start with using the parameters that were given by them in their paper. Additionally we also used grid search for searching the space of parameters to find the best results but we only report the best results because of limitations in space. In order to determine the best set of parameters we computed the KL divergence of the simulated versus the real distribution of guild sizes. Given a discrete random variable and probability distribution *P* and *Q*, the KL divergence of *Q* from *P* is defined as follows:

$$D_{KL}(P||Q) = \sum_i P(i) log \frac{P(i)}{Q(i)}$$

The following series of figure from Figure 1 through Figure 6 shows the best results for the distribution of the guilds at the end of the simulation. The experimental setup is such that we start with different months as the starting point for the simulations and then compare the distributions at the end of the time span *i.e.,* September 2006. Thus consider Figures 1, 2 and 3 which show the distribution of the guild sizes. The months in this case (March, May, July) refer to the starting point for the simulated i.e., the data which was used as the seed for the simulation. In Figure 1 through 6, "Actual" refers to the data collected from EQ2 and "Team Formation" refers to the results from the simulations where the team formation proposed by Johnson et al is used and "Kinship" refers to the Kinship model described in their paper. The x-axis is the size of the guilds and the y-axis is the number of guilds for which that guild size is observed. In contrast to previous studies the results here are given at both the character level as well as the account level. It should be noted that the distribution of the guild sizes are different at the character level as compared to the account level as participation rates of players may vary. This is because in many

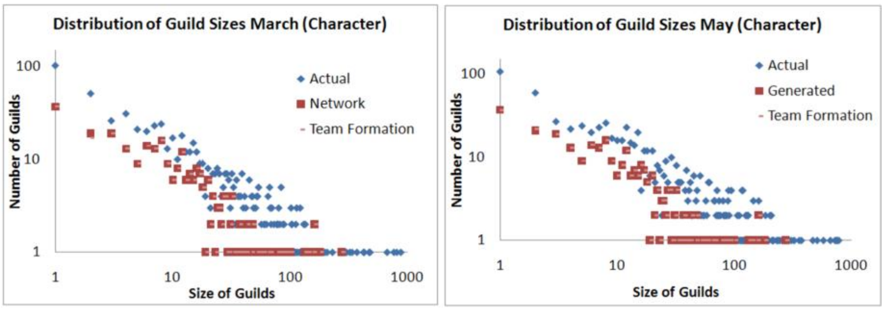

Figure 7 and 8: Distribution of Guild Sizes at the character level for network and the team formation models when March and May data is taken as the seed

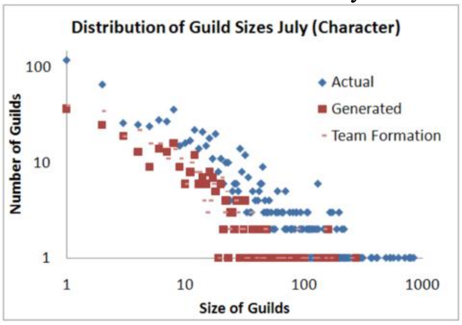

Figure 9: Distribution of Guild Sizes at the character for the network and the team formation model when the data from July is taken as the seed respectively

cases the same account may have multiple characters. In general the results are better at the account level as compared to the character level.

If we compare these results to the results reported in Johnson et al [10] for the self-organized guild model in their paper then it is clear that the discrepancy is much higher in the EQ2 data as compared to WoW. They also reported that they obtained a poor fit between the guild distributions and the simulated data if the homophily based model was used. In our case while this is true for most of the case, for the extreme values of tolerance (0.95) for the homophily model, we do get results which are comparable to the other team formation model as evident in Figure 1 though Figure 6. This is also in contrast to the results of Johnson et al where they did not find any support for homophily. This points towards a major difference between EQ2 on one hand and WoW and street gangs in LA on the other hand. Additionally we also report the results of our simulations using the modified model. In EQ2 a strong form of social relationshiop between players can be inferred based on the trust between them since the game has a built in mechanism where players can describe how much they trust other players. We thus us the trust information to modify the model that if there is a trust relationship between two nodes then it becomes more likely that players will get together in guilds and are more likely to stay in guilds. Here we give the results at the character level only due to limitations in space, in Figure 7 through 9 for our modified kinship model as well as the original model of Johnson et al.

From these figures it is apparent that the best results from the network based model are indistinguishable from the group formation model, except in the case of using July as the seed, even though the network model is obtained by modifying the homophily or kinship model The main thing to note here is that it is possible to get the same results and fit as the team formation model by just making minimal changes to the homophily model. We observe the same model dynamics for the various models described here i.e., overall the results are better in case of the models at the account level as compared to the character level. Taken together with the results from the self-organized model, these observations points us to the direction that such models may be inadequate with respect to modeling characters as the fundamental level of analysis but they work well at the account level.

7 Conclusion

In this paper we tried to replicate a previous model of evolution of groups in virtual worlds, critiqued flaws in its data and assumptions, and proposed a new model that can be used when back-end data are available. Both EQ2 and WoW are massively multiplayer online role playing games and are similar to one another in many respects. One would expect that the evolution of guilds in these two environments would be similar, yet our results suggest otherwise. On the contrary, one would expect the street gangs in LA and WoW to be less similar as compared to EQ2 but the opposite is observed. While there may be sufficient similarity between WoW and LA street gangs, it is possible that the observed similarities are only applicable to WoW alone, and may not generalize to other MMOGs. This implies that online worlds could have distinct features and nuances, so much so that their social dynamics cannot be assumed to be similar across virtual worlds. Mapping from online contexts to offline contexts should be based on multiple studies since some online environments may be similar to offline settings while others may not be even though they may seem to be sufficiently similar. It is also important to map the dimensions of what exactly is meant by "diversity," as a principle for group formation. Biologically based diversity operates on a different principle than skill-based diversity in an environment where identity may not play as strong a role as efficiency and strategy. Offline, while people may have different aspects of their personality, they aren't actually physically different with different appearances and skills from context to context [7]. In virtual worlds, this is common and trackable in many cases. Any analysis must account for this multiple personality equivalent before beginning calculations.

We proposed an alternative model for the evolution of groups. The results showed some improvement over the previous models. Given that discrepant results were observed for WoW and EQ2, which are both MMOGs and one would expect them to behave similarly, we caution against the generalizability of either of the results and recommend that such models should be explored in greater detail and in more datasets from other virtual systems before any generalizations can be made. Also, models based on homophily give comparable results to the other team formation models in EQ2, if sufficiently high values for tolerance are used. Thus it is likely that some form of homophily plays a role in guild formation and evolution in EQ2 but has a minimal role in WoW and gangs in LA.

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