Massive Online Games and Loot Distribution: an Elusive Problem

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ABSTRACT

Massively Multi-player Online Role-Playing Games (MMORPGs) and Massively Multiplayer Online games (MMOs) are complex socio-technical distributed systems. In these environments, a huge amount of players interact to have fun and develop their characters. Looting systems have been developed to help allocating valuable in-game objects, gained after finishing quests, as fairly as possible among the participating players. The medium/long term effects of the adoption of different Looting Systems on players have not yet been adequately investigated, in spite of the fact that they could impact heavily on players' satisfaction. In the present work, we move a first step in this direction in order to offer several hints for improvement to game designers and companies developing and managing MMORPGs and MMOs.

Categories and Subject Descriptors

I.6.5 [Model Development]

General Terms

Design, Human Factors.

Keywords

Massively Multiplayer Online Games; Videogames; Games Theory; Simulation.

1. INTRODUCTION

Massively Multi-player Online Role-Playing Games (MMORPGs) and Massively Multiplayer Online games (MMOs), belong to a game genre in which a player interacts with other players in an online, persistent, and shared virtual world. This genre is gaining more and more (business) success and diffusion, propelled also by the renowned success of Blizzard's World of Warcraft (WoW) [12], which counts more than 11 millions paying users worldwide. Such a huge amount of people interacting on an ongoing basis raises question for game designers and computer scientists that have scarcely being investigated till now. Actually, beside the issues related to game mechanics and the like, there is a number of other – only apparently – minor "tricky" situations that could, nonetheless, impact deeply on the success and survival of a specific game. Quite serious problems of players' loyalty may arise, for example, from characteristics that are intrinsic to the paths players have to follow to raise the "level" of their character. Actually, two relevant aspects of MMOs are the ability to level up your character and the ability to collect rare "valuable" objects (e.g., potions, swords, etc. – in a fantasy-based world). Moreover, players' characters, depending on the specific virtual world, could belong to specific *classes* (e.g., mage, cleric, warrior, etc.) or have specific *skills* (use of ranged weapons, potions crafting, etc.) [3]. This means that different players may target slightly different goals in order to level up, and that players belonging to different classes are often interested into collecting different rare objects. Due to these differences, players are also forced to collaborate to proceed in the game, e.g., by participating into multi-player quests, *dungeons* or *raids*. In other words, by gaining "experience" in-game (e.g., by monsters slaying, puzzle solving, *raiding*, etc.), the player character will become stronger and stronger, thus being able to take on harder and harder tasks and gaining a brighter "reputation" among other players. Moreover, a higher character level, generally, implies the possibility to obtain, wield and exploit rarer and more powerful items (e.g., in a fantasy world: weapons, armors, or enchanted equipment). At the same time, these higher level items often improve the *statistics* of a character, making these objects (also said "artifacts") highly desirable [3].

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1.1 The Looting Problem

To collect specific rare items, it is necessary to kill specific monsters (also called *bosses*), which may *drop* a *loot* composed also by the rare objects. Slaying such bosses generally requires the joint effort of a certain – varying – number of players, which have no a priori guaranteed advantage, since the rare object(s) "dropped" by the dead boss may be taken by other players or even be of no interest (e.g., because useful only for a another character class). The above characteristics may be the intrinsic cause of clashing interests, which may lead to even very harsh disputes among players. As easily understandable, such situations are generally undesirable, since may lead a certain number of (paying) players to abandon the world. Other possible drawbacks are the creation of unofficial "black markets" were valuable objects are sold (e.g., using eBay) and a negative effect on the *newbies* flow (a constant, stable inflow of new players is the prerequisite for a successful and lasting MOO, as pointed out by [3]).

Anyway, to deal with the trade-off between personal and group interests, players have developed several self-enforcing and non-pecuniary resource allocation systems – called *Looting Systems* (LSs) or *Loot Distribution Systems* – to allocate goods produced by a combination of player effort (the effort required to organize a group and overcome challenges) and the game itself (which "generates the good") [5, 6]. LSs may or may not be implemented directly into the game: in the majority of cases, they take the form of *gentlemen agreements* among the players, and are rooted into their mutual trust and honesty. In spite the fact that the loot problem may become central in the management of a MMO, quite few deep studies have been conducted on this topic, and the majority of the currently available information can be derived from users' forum, blog and wikis (see e.g., [13]).

The contribution of the present work aims at moving a first step into the comparison of the effects, on the player community, of the adoption of different LSs. The analysis will try to take into account both the point of view of the players and the one of the game designers and/or community managers. To achieve this goal, we will adopt an approach rooted into the games theory (that can be useful to approximate certain aspects of the behaviour of a social system when cooperation is required - see e.g., [1,2,4]) and the simulation of social phenomena supported by multi-agents environments.

2. LOOTING SYSTEMS

When a player (or a group of players) sets its mind up to start a new multi-player mission, the first step is to decide which LS should be adopted. As a consequence, players willing to participate in the mission have to deal with a decision similar to the *Ultimatum Game*: either they can decide to participate and get whatever they will (if anything) or give up. This step is of central importance: as Nash, the founder of the game theory, underlined in his work, choices, rules, and pay-off depends on the specific game (LS in this case) and influence the behaviour of players [9]. As a consequence, and according also to the *mechanism design* (see e.g., [7]), a strategic choice of the LS could influence the evolutionary direction of the groups of players and of the whole in-game community.

The most diffused LSs and their major variants have the following characteristics [11]:

- Council: a *Raid Leader*, sometimes helped by a group of advisors, decides how the loot will be allocated. The system is completely not deterministic and often leads to overheated discussions.
- Rolling: each player interested into a specific object rolls a dice: the higher result wins. When more than one player is interested into an object, specific netiquette rules can be put in place (e.g., classifying players into *needers* and *greeders*, see [11])
  - *Karma*: the same as rolling, but the player can add a *bonus* to the roll. The bonus is an amount of points she may have collected thanks to her actions (e.g., helping others, being particularly brilliant in a mission, etc.)
- *(Pure) List*: players are enrolled into a circular list, and the loot is distributed according to a *first come first served* policy
  - *Suicide kings*: like the previous, but each player can choose to accept or refuse the objects.
- *Dragon Kill Point Classic*: similarly to what happens in the Karma system, players accumulate *Dragon Kill Points* (DKPs), that are used – instead of money – to *acquire* the right to take a specific loot object. Different possible variation are possible (players are always ordered in lists):
  - *DKP fixed prices*: every object in the loot has a fixed price. The player can "buy" the item if she has enough DKPs. Here, also, players are ordered in a list: the more DKPs, the higher the position in the list.
  - *DKP with variable prices*: the price of the objects is equal to a relevant percentage of the total DKP owned by the player interested into it.
  - *DKP with auctions*: the following types of auction can be adopted to distribute loot objects: English, Dutch, first-price sealed-bid, second-price sealed-bid.
- *Dragon Kill Point Zero-Sum*: DKPs are produced by a zero-sum game, in order to avoid inflation and guaranteeing a more fair distribution of objects among players belonging to a specific group. Every time a player buys a loot object, the total amount of DKPs she spends is divided equally among all the other players in the group.
- *Dragon Kill Point Relational*: in this case the players order in the list is calculated on the basis of the ratio between gained point and spent points (*Effort Points* and *Gear Points*). The aim is to give occasional players a fair opportunity to participate in the loot distribution.
- *Dual Token*: each player has a pair of non-cumulative tokens (*Greed* and *Need* Tokens). All the players interested into a specific loot object may spend their Need token: the winner will be chosen by chance. If no one spends her Need token, Greed tokens can be put in place in the tentative to obtain the object for speculative finalities.

The main idea of our work is to simulate the medium/long period effects of the adoption of one of the above described LSs on a community of play [10] in a MMO.

2.1 Players' Behaviour

We have excluded from the analysis (hence not modeled) extreme behaviours, such has *lone players* and *ninja looters* [11]. None of them is interested into cooperation and trust; hence, the LS choice is quite uninfluential on their behaviour.

The use of game theory alone, even if it is useful for simulating Ninja looters behaviour, would have been not enough to describe in details the different LSs we have decided to compare. Hence, we have adopted a simulation tool in order to go beyond the mere pay-off maximization and to take into account also social interaction among player, which is a critical factor in MMOs. In particular, we have chosen NetLogo [8], a multi-agent environment used to simulate natural and social phenomena.

3. THE PLAYER PERSPECTIVE

The main goal of the simulation is to approximate the behaviour of a large number of players playing in groups in the same MMO, when different LSs are adopted. To define the agents, we have focused our attention on *quantity of time* a player devotes to missions and on her *experience*.

- *Quantity of time*. Agents have been distributed equally into three groups: *hardcore* players (which play 6 days a week and 90% probability to participate in every mission), *midcore* players (4 days and 60% probability) and *casual* players (2 days and 30% probability). The distribution of player types in each group is random.
- The player *experience*, approximated by the time passed from the moment she subscribed in the MMO, simulates how much it is important that a player belongs to a specific group since a long period. To achieve this effect, several agents have been programmed to begin playing later than the others.

We have defined 240 missions (to which it is possible to participate within a group of 40 players): only one valuable object can be found in a mission (this mirrors quite well a typical *raid* in WoW). The MMO population counts 200 individuals, among which 20 agents start to play from mission 101. Objects are characterized by a *value* v that varies among 1 and 5. The increase in characters "power"/level is directly proportional to this value. Anyway, objects with the same value, but with different *properties*, not necessarily provide the same increase in power/level. Hence, the increase for each v is represented by $i>0$ chosen on a normal distribution with average μ and variance 5 (see Tab.1 and Fig.1).

Table 1: Relation between v and μ

v	μ
1	20
2	40
3	60
4	80
5	100

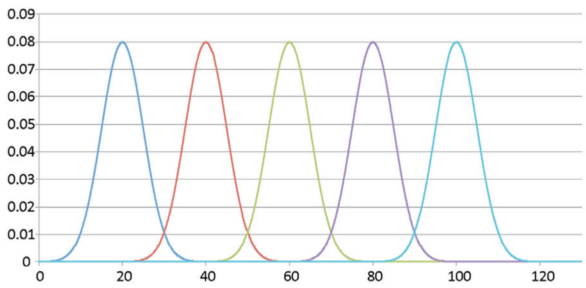

Figure 1: Probability to obtain an increase in power according to the value of the object

This means that the preference of players for a specific object is random and reaches its maximum one time out of four.

The minimum required number of simulations, n_s, has been calculated using the method of independent replications by means of the following formula:

$$n_s = \left(z_{\alpha/2} \frac{\sigma}{L} \right)^2 \quad (3.1)$$

In the formula, $z_{\alpha/2}$ is the required accuracy, calculated as the z-value of the 1-(α/2) percentile of the standard normal distribution, σ is an estimate of the coefficient of variation taken from a pilot run, and L is the desired relative error.

A typical value for both α and L in literature is 0.05; i.e., to determine a confidence interval of 95%. We decided to keep standard values as it is out of the scope of this specific contribution to dig into the correlation between confidence interval and model accuracy.

The value of σ has been estimated running a preliminary simulation of 10 iterations and $z_{\alpha/2}$ has been looked up from a standard normal table. Using these values in the aforementioned formula we obtain calculate n_s to be 240.

The outcomes of the simulation are summarized in Fig.2, where bars represent a measure of the average increase in players power/level after 240 missions.

In spite of the fact that our model is a very simplified version of the complex socio-technical system of a MMO, the results of the simulation underlines that certain LSs are actually more favorable to specific players types. As an example, hardcore players should prefer the adoption of the fixed-price DKP system, while newbies should opt for a Zero-Sum DKP system.

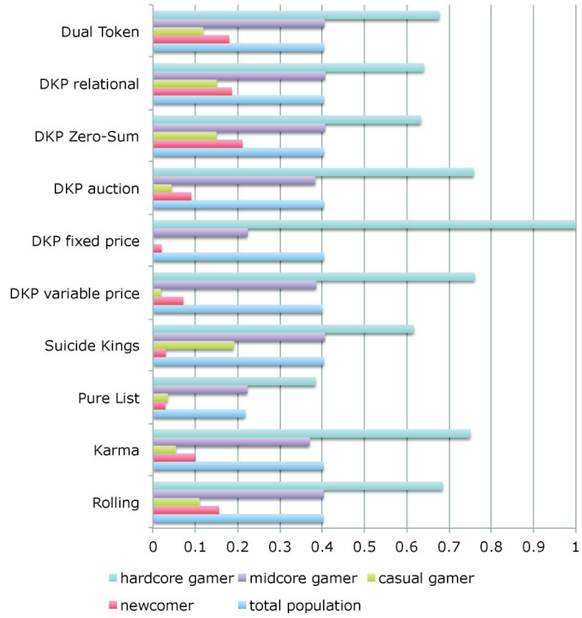

Figure 2: Normalized final average power/level increase

4. THE GAME DESIGNER PERSPECTIVE

If we shift perspective and consider the whole MMO world from the point of view of the game designer, the information that can be derived from the previous simulation is clearly insufficient. As a matter of fact, the goals of the company managing the game are to maximize both the number of (paying) players and their satisfaction; hence, the vision of a single individual is not enough. Experience and theoretical studies have enlightened that MMOs players can be clustered to form macro-categories that can be found in every massive game [3]. Players belonging to a specific category share common behavioural traits; hence, their relative number may influence heavily the general climate of a specific world, and – possibly – its success or failure. As a consequence, specific characteristics of the world should be carefully designed

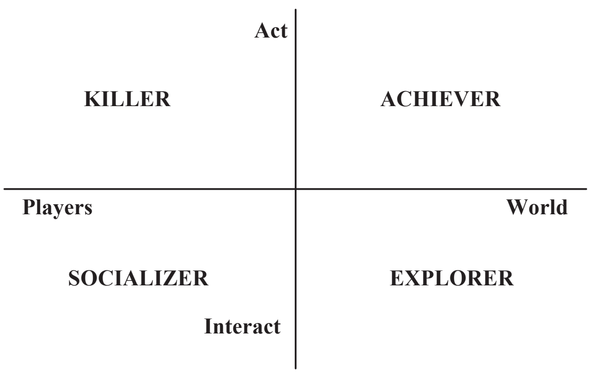

Figure 3: Basic player types according to Bartle' model

in order to obtain the ideal balance among the different player types. In this framework, our goal is to verify if the choice of a specific LS can influence – and to what extent – the balance among player types.

The players categorization that we have adopted is based on the well-known Bartle's model [3]. We have included into our simulation only the four basic player types: *Killer*, *Achiever*, *Socializer* and *Explorer* (Fig.3), since their mutual interrelations are well known [3]. In particular, Fig.4 summarizes the variation in the number of player of a specific type when another type varies too: an arrow represents an increase (solid) or a decrease (dashed) of the player type where it origins; the effect on the target player type can be an increase (solid tip of the arrow) or a decrease (empty tip); the arrow thickness represent a small (thin line), medium (medium line) or heavy variation (thickness).

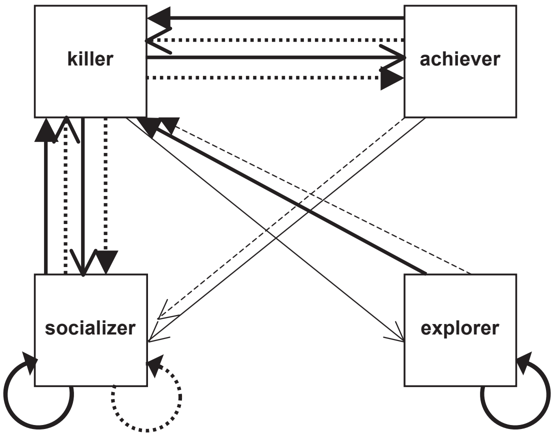

Figure 4: Mutual interrelation among the number of players in each type [3]

The simulation we have built aims at choosing the best LS for a MMO populated by 500 players, each of which is characterized by belonging to the type *t* (were *t* can assume one of the following values: Killer, Explorer, Socializer, or Achiever) and to the class *c* (were *c* can assume one of the following values: Warrior, Mage, Cleric, and Thief). The possible loot objects are 15: three of which are specific to each class (they may represent armors, magic wands, etc.) and the remaining three are generic (useful for all the classes) and consumable (they can be used only once, then they disappear from the equipment of the player). Each object has a value that ranges from 0 to 9 (the highest, the rarest). In each mission 6 objects are found and a group must be composed by 5 players (including at least one warrior, one mage and one cleric) and no more than two player belonging to the same class (which is the typical number and composition for a *dungeon* quest in WoW).

Since the quantity we would like to measure is no longer the increase in character power, but something subtler such as the favorable reception of the different types of player for different LSs, we have defined the following expression, that, for a player *a*, measures the *satisfaction P* of obtaining a loot object *x*.

$$P(a,x) = val(x) + class(a,x) + type(a,x) + o\_poss(a,x) + o\_ric(a) \tag{4.1}$$

Were all values are integer and defined as follows:

- *val(x)* = [0, 9] is the value of the object
- *o_poss(a,x)* indicates if another object of the same type is already in the equipment of player *a*. If the value of *x* exceed the value of the object possessed, then *o_poss(a,x)* = 9, otherwise *o_poss(a,x)* = *val(x)* – 1. For generic consumable objects this value is always 9
- *class(a, x)* measures the relevance of object *x* for the class *c* to which the player *a* belongs. If the object class and the player class are the same, then *class(a,x)* = 9, otherwise *class(a, x)* = 0. If *x* is a generic consumable object, then *class(a,x)* = 5 for any player class
- *type(a,x)* = [0,9] measures how much player *a* desires object *x* in relation with her type *t* (e.g., Killers will probably be more interested into offensive objects)
- *o_ric(a)* = [0,9] indicates the ratio between the number of missions into which player *a* has contributed and the objects she has received till that moment. The desire to obtain object *x* is directly proportional to this ratio.

As a consequence *P(a,x)* = [0,45]. Example: if player *a* (*c* = warrior, *t* = socializer) has not yet taken an object and *x* is an item for her class with *val(x)* = 6, then *P(a,x)* = 6 + 9 + 3+ 9 + 9 = 36. For every LS, if *P(a,x)* ≤ 10, then the interest of player *a* for the object *x* is at its lowest, if 10 < *P(a,x)* ≤ 40 then it is possible to calculate the probability that player *a* will try to get the object; when *P(a,x)* > 40 the possibility that player *a* tries to get the object become a certain event. It is important to recall that the decisions among which player *a* can choose are constrained by intrinsic characteristics of each LSs (e.g., in Dual Token, player *a* can decide to use a token only if she has one). For the sake of clarity, in Fig.5 we have summarized all the possible decisions for player *a* under different LSs.

We now define the *satisfaction G* that player *a* has for a certain LS as a function of the total number of objects that player *a* gets and of their relative *P(a,x)*. As a consequence, *G* (in *m* missions with *n* objects each) is the sum of the values of $P(a,x_j)$ for the *j* objects she actually got in *i* missions plus the quantity $like\_mission_i(a)$ that measures how much *a* liked the mission *i* independently from having obtained an object:

$$G(a) = \sum_{i=1}^{m}\left(\sum_{j=1}^{n} P_i\left(a,x_j\right)\right) + like\_mission_i\left(a\right) \tag{4.2}$$

We have then further refined the set of rules regulating the creation of a group defined in Sec. 3: after each mission *i*, player *a* verifies P_i for the objects she managed to get and, if P_i is greater than *P* for each previous mission, then it is saved together with the list of the other players belonging to the group (implying that they have contributed in obtaining a greater satisfaction). When a new group is formed, each player will accept to join the group with a certain probability, which varies according to the presence of players belonging to this saved list (see Tab.2).

Table 2 - Probability for player *a* to join a group

Players in group	Buddy list empty	Buddy list not empty no friends in the group	Buddy list not empty at least one friend in the group
0	70%	70%	70%
1	70%	60%	90%
2	70%	50%	90%
3	70%	40%	90%
4	70%	30%	90%

System	Actions		
	throw dice use token make offer	use bonus	take object
Rolling	●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$		
Karma	●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 20$ ○$20 < P(a,x) \leq 40$	○$P(a,x) > 40$	
Pure List			○$0 \leq P(a,x) \leq 45$
Suicide Kings			●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$
DKP with variable prices			●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$
DKP with fixed prices			●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$
DKP with auction	●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$		
DKP Zero-Sum			●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$
DKP Relational			●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$
Dual Token	●$P(a,x) \leq 10$ ◐$10 < P(a,x) \leq 40$ ○$P(a,x) > 40$		

Figure 5: Possible decisions for player *a* when using different LSs. Rounded symbols indicates that a certain decision may be taken always (white circle), with a certain probability (half-black circle), or never (black circle).

Each simulation includes 1000 missions. The minimum number of simulation has been calculated with (3.1), where $L = 0.15$ in order to reduce the error. Simulations have been conducted with different populations, each of which dominated by a specific type of player (70% of the total population). Sample results (normalized) for population dominated by different player types are shown respectively in Fig.6, 7, 8, and 9 and briefly discussed in the following paragraphs.

4.1 World Dominated by Socializers

According to Bartle clusters, socializers perceive the MMO world more like a place for meeting new people than a game. Their main goal is a peaceful and friendly interaction with other players; hence they generally do not overheat for futile reasons like not grasping a valuable object. They generally create tightly knitted social networks, and a predominance of socializers attracts more socializers and also more killers (that merrily welcome the opportunity to disrupt such an idyllic landscape). Since socializer are not interested in obtaining an object at any cost, the variable *type(a,x)* in (4.1) assumes the value 3 for objects relevant to the player class *c*, 2 for generic consumable objects and 0 for other objects. Moreover, in (4.2), we assume *like_mission(a)* = 9, to mirror the fact that a socializer particularly appreciate spending time with other players. As Fig. 6 shows, in a world dominated by socializers, LSs help particularly achievers (actually they can fulfill their main goal – collecting objects – more easily, since socializers will not upset that much for such a loss). Anyway, in this case, the best LSs are Dual Token and Karma.

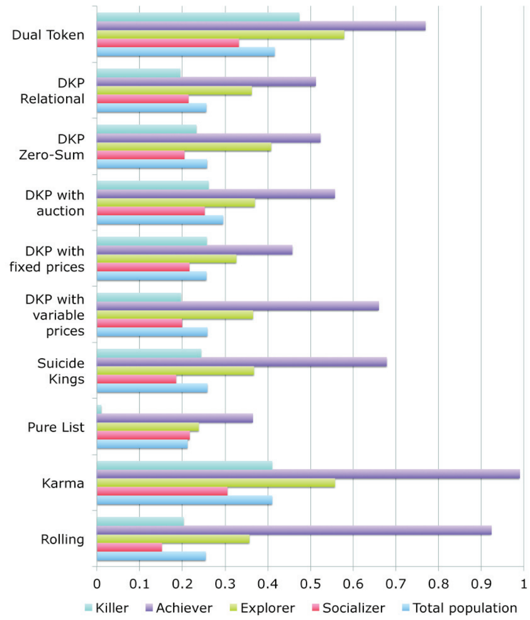

Figure 6: Simulation results: population dominated by Socializers

4.2 World Dominated by Explorers

According to Bartle clusters, explorers are particularly interested in the interaction with the virtual environment of the MMO. Their fun consists in gaining a perfect knowledge of any "secret" detail of the synthetic environment and of the possibility offered by the game. Due to their deep knowledge of the game environment, explorers are usually considered highly valuable resources by other players. This type of player is not particularly attracted by power increase, unless it could be useful for increasing their knowledge of the game details. A world dominated by explorers is appealing for other explores and not appreciated by killers (this is generally a desirable condition, since a high number of killer could cause the depopulation of the world). Since explorers are interested into obtaining only the objects useful for increasing their knowledge of the world, the variable *type(a,x)* in (4.1) assumes the value 7 for objects relevant to the player class *c*, 9 for two generic consumable objects and 5 for the remaining generic object, and 0 in the other cases. In the same vein, in (4.2), we assume $like\_mission_i(a)$ = 7, to mirror the fact that the participation into a mission could offer the possibility to gain new knowledge and/or to explore areas of the world that cannot be accessed by a single player. In a world dominated by explorers the most suitable LSs seem – again – to be Dual Token and Karma (Fig.7). Moreover, the satisfaction of socializers seems to increase a little.

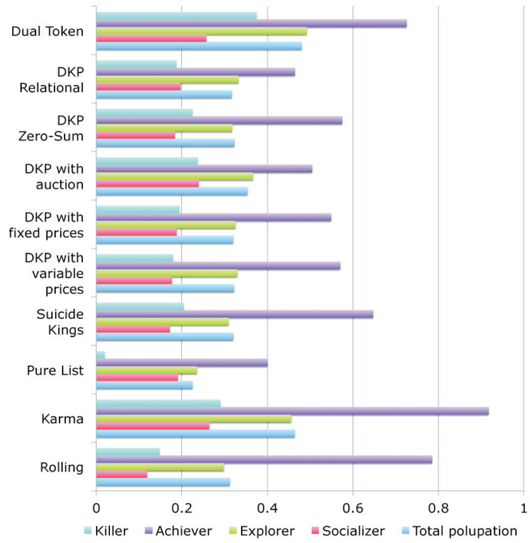

Figure 7: Simulation results: population dominated by Explorers

4.3 World Dominated by Achievers

According to Bartle clusters, achievers' goal is to win prizes (both tangible and intangible, such as an increase in their social status). This could imply raising their characters to the maximum level, accumulate points, collect anything that is collectible, etc. Any other player is perceived as a rival, and they are very greedy when loot objects have to be distributed. A predominance of achievers makes a virtual world appealing for killers and a bit repulsive for socializers. The variable *type(a,x)* in (4.1), when *a* is an achiever, always assumes the value 9, except for generic consumable objects, whose value is set to 7. These values take into account the propensity of achievers to collect everything. Moreover we assume $like\_mission_i(a)$ = 4, since achievers are not much interested in socializing and could consider a mission that do not provide objects as a time loss. It is important to notice (see Fig. 8) that, in a world dominated by achievers, the satisfaction they could derive from different LSs is generally less that the satisfaction they derive from the same LSs in worlds dominated by players belonging to other types. This effect is consistent with the higher level of rivalry that characterizes achievers, which grows with the number of players of this type competing in the same world. Anyway, the most effective LSs seems to be Dual Token and, partially, DKP with auction, which has a lower appreciation by killers (but, as we saw, this could be considered a good thing, since it could discourage the growth of killer number).

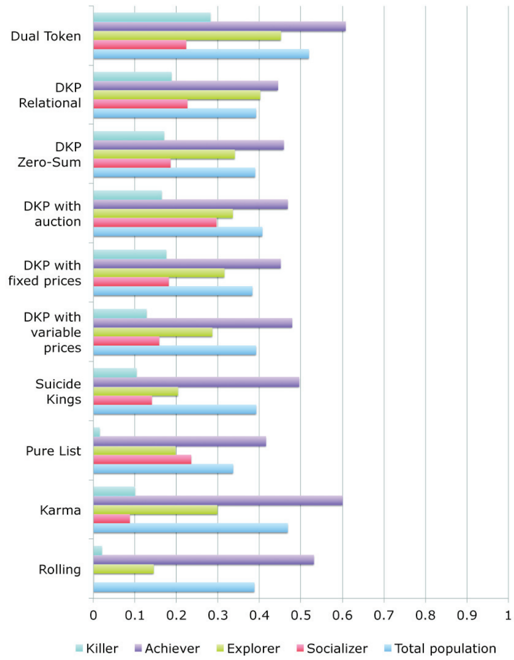

Figure 8: Simulation results: population dominated by Achievers

4.4 World Dominated by Killers

The final goal of a killer – according to Bartle – is to dominate and overwhelm other players thorough fear and bullying. They perceive other players as enemies, especially when they run into newbies that are among their favorite bullying targets. Killers could turn into a thorny problem to deal with for the managers of the game. Bartle underlines that a conspicuous number of killers translates into a strong decrease in the percentage of socializers and achievers and in small decrease of the explorers quantity, too.

In the case of killer players, the variable *type(a,x)* in (4.1), assumes value 9 for objects coherent with player class *c* and for two generic consumable objects, value 5 for the remaining generic consumable object, and value 0 in the other cases. This type of player is not interested into participating to a mission for the pleasure of cooperation, hence $like\_mission_i(a) = 2$.

The results of the simulations, when compared with the results obtained from worlds dominated by other player types, show a average decrease in satisfaction for all the types of players and for all the LSs. Again, Dual Token and Karma are among the most desirable LSs.

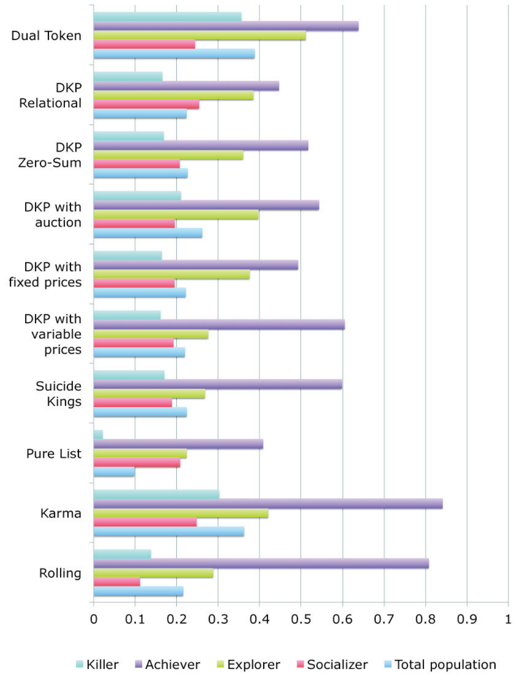

Figure 9: Simulation results: population dominated by Killers

5. CONCLUSIONS AND ONGOING DEVELOPMENTS

Regardless the dominating player type, the most satisfactory and fair LS seems to be Dual Token. Except in the case of achievers, Karma is also a satisfactory LS. Achievers have generally a higher average appreciation for LSs, and this seems to be consistent with their interest in collecting objects: actually their appreciation is not necessarily derived from the number of objects received, but from the fact of having obtained them.

Although the results obtained so far seem to offer intriguing hints for discussion, we are well aware that our models and simulations are well away from being a reliable approximation of the huge complexity of a socio-technical system existing in a MMO with a large user-base. For this reason we are planning several refinements, in particular:

- The development of a new LS that builds on the positive traits of Dual Token (and the subsequent testing with different populations)
- To run several simulations that include the possibility to change LS between missions (this could be a better proxy of reality, since in the majority of cases the LS is chosen by players, and not imposed by the MMO)
- Further refinements of the conceptual framework, e.g. by combining Bartle's players type with the classification into hard/midcore and casual players.

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