

Factors and Processes Involved in Collaborative Learning and Problem Solving in Massively Multiplayer Online Games: Aspects of the Designed and the Social Environment

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Abstract

Massively Multiplayer Online Games (MMOGs) constitute virtual environments rich in task-oriented and social interactions among players. These interactions are directed both by the design of the environment as well as by the community of the players. There are strong indications that these environments constitute, beyond of environments for fun, environments of collaborative learning through interactions with peers. Through this paper, we review research in the area of collaborative learning and relate it to relevant findings from the area of research in MMOGs and findings from our own research, in an attempt to formulate a conceptual model for the investigation of collaborative learning processes in MMOGs.

Keywords

MMOGs, collaborative learning, collaborative problem solving, social interactions, online games, collaborative virtual environments, MMORPGs

INTRODUCTION

Massively Multiplayer Online Games (MMOGs) seem to be more than merely environments for entertainment: they constitute environments rich in social interactions among the participants where the players, within the framework and the affordances of the environment, interact and communicate with other real players, they form virtual communities, they get organised in groups, they cooperate and compete with other players, they help, support and mentor each other, they develop real-life relationships and friendships, and they socialise or direct their joint efforts to a common goal. Their highly social nature, the interactions and exchanges among players, the evolution of their design and development over the past decade and their increasing population of users, amounting to millions of players, have brought them to the focus of attention in fields such as sociology, economy, psychology and learning.

Review of relevant research suggests the potential of MMOGs as learning environments (De Freitas, 2009, Ke, 2009, Steinkuehler et al, 2007). Despite the indications for their learning potential, there is little empirical evidence on the interactions that promote collaborative learning in the multiplayer game environment (Meredith et al, 2009). Effective exploitation of the benefits of collaborative gaming on learning and education requires the development of novel models and tools for addressing these highly dynamic and social environments (Schrader and McCreery, 2008; De Freitas, 2009). Our paper is situated with this context.

Our approach for investigating MMOGs as environments for collaborative learning was directed by three main axes, relevant to the investigation of collaborative learning: the social perspective, the cognitive perspective, and the motivational aspects of the environment.

Theories such as Situated Learning (Lave and Wenger, 1991), Activity Theory and Embodied Embedded Cognition, situate learning and the acquisition of knowledge within the framework of the interaction of the individual with the world and the social-cultural environment. A major concern for collaborative learning research is the investigation of the factors that positively influence the emergence of collaborative learning activities and cognitive mechanisms (Dillenbourg, 1999). Dillenbourg (op. cit.) identified three broad areas of focus in the area of collaborative learning: the learning processes and outcomes, the number of people involved, and the different forms of interaction.

Team learning behaviour involves processes such as the construction and co-construction of meaning through conflicts, and the development of mutually shared cognition, leading to higher team performance and effectiveness (Van Den Bossche et al, 2006). Factors such as the interpersonal context, the individuals' beliefs and attitudes (ibid) and the relational context, the quality of the interactions and communication among group members (Barron, 2003), seem to be critical factors for the emergence of learning behaviours and processes, the effectiveness of the team as well as for positive individual learning outcomes.

Motivation for the engagement in the learning activity is another significant factor involved both in individual and in collaborative learning. Motivation or "will" as described by Mayer (Mayer, 1998) may be individual, emerging from the individual interests and preferences of the learner, or situational, emerging from the environment and the tasks. Motivation is also being situated within a social context. It is influenced by the social and cultural environment (Dillenbourg et al, 2009, Järvelä and Volet, 2004). Research in the area of motivation and learning provides empirical evidence that not only the cognitive component but also the motivation component and affective aspects have an impact on learning and the strategies employed by the students (Boekaerts, 2001, Volet, 2001, Volet and Järvelä, 2001).

Through our study we propose and apply a conceptual framework of research for the investigation of collaborative learning interactions in MMOGs, within the context of social constructivist-based learning approaches. In this study we adopt an exploratory and ideographic approach, as we try to investigate existing tendencies, by concentrating on behaviours and beliefs of individuals, rather than extrapolating our results and generalising on the behaviour of the general population of players and MMOG environments. We aim to investigate the existence of collaborative problem solving and learning processes and their relation with designed features of the environment as well as with social phenomena emerging.

The objectives of this study are:

1. To propose a conceptual model for the investigation of collaborative problem solving processes in MMOG environments.
2. To investigate the ways and processes through which players are engaged in collaborative problem solving activities within the framework of an MMOG.

Learning in MMOGs is mainly addressed through ethnographic studies and self-report surveys. In our study we have collected data from interviews of players, actual game-play of players (video recordings) and participant observation in two

MMOGs of different format, in order to acquire a better insight of the interactions and in-game behaviour of players.

DEVELOPING A COLLABORATIVE PROBLEM SOLVING MODEL FOR MMOGS

As discussed in the Introduction, research on collaborative learning in MMOGs requires novel models and tools for the consideration of the complex factors emerging. For the conceptualisation of the factors involved in the collaborative learning processes, and the development of a model, we implemented ideas and concepts from different research areas (Van Den Bossche et al, 2006), such as collaborative learning, collaborative problem solving, motivation and group dynamics. In this section we will describe our research method; we will discuss our proposed conceptual model, and apply it to the investigation of the collaborative learning processes as emerging in our observed MMOGs. Our aim is not to generalise our findings but rather to contribute to the development of research frameworks addressing the complexity of MMOGs as social environments and identify emerging trends in collaborative processes for learning in MMOGs.

Research Method

For acquiring a deeper understanding of the practices within MMOGs, as well as a qualitative background for our research framework (Ducheneaut et al. 2006), we applied virtual ethnography techniques (participant observation, online and offline interviews, game-related websites and fora, screenshots, videos, logs and in-game forum content) (Hine, 2000, Hine, 2008) in two MMOGs, namely the Massively Multiplayer Online Role-playing Game (MMORPG) Lineage II (L2) for 18 months (2006-2008) for approximately 14 hours per week, and the web based, Multiplayer Real-Time Strategy Game Tribal Wars (Greek server version, World 1) for 7 months (June-December 2008). Although these two multi-player games have an entirely different environment format and design style, they both present intense task-oriented player collaboration, as well as social interactions.

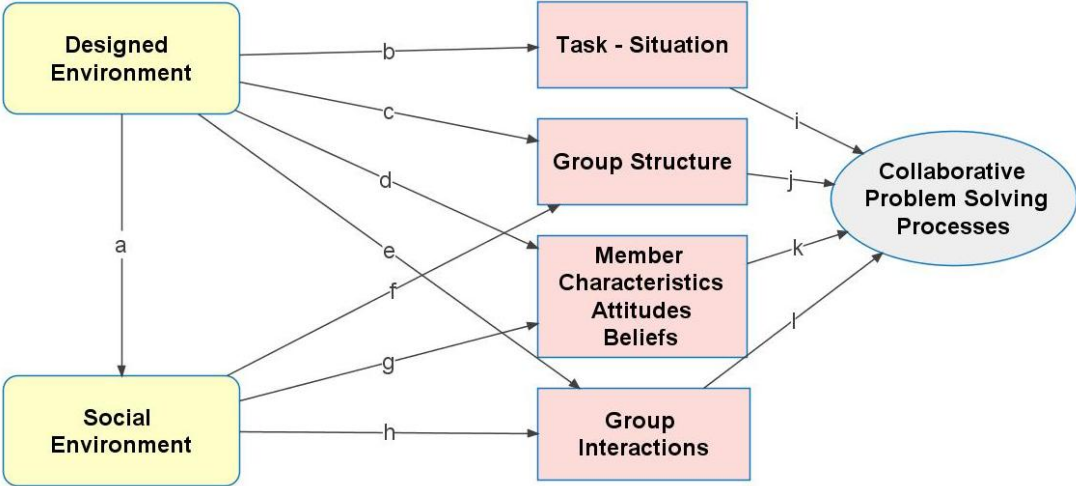
Furthermore, we conducted 18 semi-structured interviews (online and offline) with players who volunteered to participate, and 1 focus group, within the course of 12 months (December 2008-December 2009), with questions relevant to their motivation for playing games, their interactions with other players, their perceptions on the content and affordances of the environment and the impact they feel the game has on them. Participants were of different educational and professional backgrounds, mainly male with the exception of 3 females for the interviews and 3 female students in the focus group. Most of them were expert gamers, except of one novice male player, mainly living in urban areas, aged from 17-50. The interviewees were players of different MMOGs, for testing the generalisation of our framework of investigation and for identifying emerging common patterns or issues through different types of MMOGs.

Finally, we collected data from actual gameplay of players. 5 volunteers participated, recording their gameplay, in realistic situations, through the course of 2 months each (approximately 5 hours of recorded video per week, per participant). Participants were assured of the anonymity of the data and the research purposes of the study and gave their informed consent. They were rewarded for their participation with free two-month game-cards for their game and an additional gift (external hard drives).

Collaborative Problem Solving in MMOGs Model

Learning through collaborative interactions is contingent but it's highly dependable on a number of factors involved in the collaborative problem solving processes. For the study of group interactions McGrath (McGrath, 1984) proposed a conceptual

framework involving variables such as the structure of the group, the environment where the group interactions are taking place, the characteristics of each member, the task or the situation the members are trying to cope with (p. 13). For investigating the group interactions that involve learning, we modified McGrath’s model and adapted it to the objectives of our study, the features of collaborative learning processes and the affordances of the MMOGs as environments of activity, in order to further test it (Figure 1). McGrath described the properties of group members, the properties of the standing group, the properties of the task/situation, and the properties of the surrounding environment as “forces that shape the group interaction process” (ibid, p. 14).



Arrow in the Model	Relation Implied
a	The effects of the Designed Environment (DE) on the Social Environment (SE)
b	DE directs features of the Tasks/Situations
c	DE affects the Structure of the Groups
d	The impact of DE on the individual’s behaviours, beliefs, attitudes
e	The impact of the affordances of the DE on the Group Interactions
f	The SE affects the Group Structure
g	The impact of the SE on the Members’ Attitudes, Characteristics, and Beliefs.
h	The effects of the SE on the Group Interactions
i, j, k, l	Collaborative Problem Solving Processes are affected by the Task, the Group Structure, the Member Characteristics, and the Group Interactions

Figure 1: Conceptual Model for the Investigation of Collaborative Learning Processes in MMOGs

MMOGs as environments of interaction are shaped not only by the design decisions of the developers, but also by the community of active players. In our conceptual model, the Designed Environment (DE) constitutes the representation and affordances of the environment, as defined by the designers of the game, including features such as the background story, the rules of the game, the graphical

representation, the audio and music, the levelling-up processes of the players, the rewards and punishments, the communication and interaction channels available. As Social Environment (SE) we define the environment as it is formed by the emerging interactions and the conventions agreed among the players. The social interactions among the players seem, at times, to even bypass rules and objectives intended by the DE. Myers describes the “curious case” of *Twix* where the rules of engagement, as set by the community of the players, were considered more important than the integrated objectives of the game, and members deviating from these rules were marginalised and even rejected by the community (Myers, 2008). Specific aspects of the SE though are directed by the DE. Affordances of the environment such as the interdependence of the avatars, the area the voice of the player (as text) can be “heard”, and the difficulty of the tasks directs the extent and the depth of players’ relationships, through what Yee defines as “social architectures” (Yee, 2008).

Collaborative problem solving processes such as negotiation, argumentation, construction of shared meaning and cognition, seem to be affected by the environment they are taking place in, the features of the members, the structure of the group, the interactions and communication patterns of the participants, and the nature of the problem-to-be-solved. Barron (Barron, 2003) identified the quality of the interactions in a problem-solving group, the responsiveness among partners (e.g. discussion of proposals, acceptance of correct proposals) and the features of the proposals (e.g. relevance to previous context of discussion) as determinant factors for the success of a problem-solving group and of the learning occurring. Problem-based learning approaches discuss the impact of the task, the activity or the problem on the internal schemata of the students and the cognitive processes evoked (Jonassen, 2000). Van Den Bossche (Van Den Bossche et al, 2006) found positive links between team learning behaviours and social and interpersonal factors such as the individual beliefs on group potency, the psychological safety of team members, the perception that members are interdependent and the shared commitment of the team members to achieve a common goal or task cohesion.

In the next section we will investigate the factors, their relations and the processes involved in collaborative learning and problem solving in MMOGs, as described in the conceptual model, based on the data collected.

A Qualitative Approach for the Application of the Model

a. The Impact of the Designed Environment on the Social Environment: Affordances of the DE seem to have a strong impact on the SE of the game. The opportunities and conditions for social interaction among players and the communication and interaction channels available, constraint or favour the development of a social system in the environment. Koster discussed the impact of the design on the socialisation of the players, setting as a primary pre-requisite the opportunities for downtime: “Socialization Requires Downtime. The less downtime, the less social your game will be” (Koster, n.d.). He referred to specific relevant to social engineering design decisions and tactics such as the shape of the map, the layout of buildings, peaceful areas for socialization, rapid travel among places, rewards for sociability, gifting, and multiple interaction, communication and group formation tools among players (Koster, 2009).

In the web-based MMOG *Tribal Wars*, in the time between battles, the members of the “tribe” would engage in general and social chat, through the in-game forum, talking about topics irrelevant to the game, such as favourite music, jokes, films.

Peaceful areas, as it also emerged from our interviews, such as cities in MMORPGs, provide the opportunity for casual interactions among players:

“We were in a starting village and we were both in front of the NPC for the newbie buffs. He saw my nickname and he said he liked it. Since we were both Greek we got together and he proposed to go for xp¹” (F 27, L2).

Interaction affordances such as gestures, animations, whispering, shouting, provide the opportunity for the players to engage in what Nardi and Harris describe as Random Acts of Fun (Nardi and Harris, 2006), playful activities such as flirting, dancing, drinking, hugging, smiling, laughing, cheering or joking with other players. As one of our interviewees commented:

“I have this friend, for the past 1.5 years. In the beginning, he would just dance in front of me, ongame. And he is a kamael and his dance is terrible. But he was doing it just for the fun of it and little by little we became friends” (F 27, L2).

In MMORPGs the players select a specific avatar, as their virtual representation in the environment. Avatars have different skills, potential and roles in the game and are dependent on the activities of other players. This differentiation, variety and interdependence set the foundations for the development of a social and economic system. Players have to interact with each other in order to survive and progress in the game. As, indicatively, suggested some of our interviewees:

“There is a differentiation of roles in the game, aiming at the cooperation among them. [This provides] what an electrician, or a cook provides [in real life]; each one in their own domain” (M 35, L2).

“When the skills of everyone are good for everything in the game, there is no point in being with anyone else, since you can do everything yourself” (M 32, L2).

Peer mentoring also emerges as a trend in MMORPGs. During our observation in Lineage II, we had the opportunity to observe multiple instances where experienced players would provide advice and information to novice players, either spontaneously or through quests where the cooperation of low and high level players was required.

“If the player is a complete novice, he/she needs the help of a more experienced one. Otherwise he/she will either abandon the game or he/she will remain a noob. [...]. That is he/she will playing, but he/she will never learn. [...]. He/she will be wearing the wrong clothes, he/she will not do any damage, he/she will not know how to play” (M 46, WoW).

The difficulty of tasks also provides an opportunity for cooperation and interaction among players. In Lineage II (L2) and World of Warcraft (WoW) certain tasks or quests are designed so as to require the participation of group.

“From a point onwards, things get so difficult that you need a team. This is actually the sense of the multiplayer aspect. There is no point in easily playing alone; you need at least 2-3 more people” (M 32, WoW).

“The game compels you to join a team because of the requirements of the game, because you have to get dressed. [...]. This will give you more potential for damage or healing” (M 46, WoW).

Yee also referred to the social architectures of MMOGs, the strong social links and bonds emerging as a consequence of the difficulty of tasks, the severe penalties, and the interdependence of the characters (Yee, 2008, 2009).

Conclusion: As it emerged from the literature review and our study, the DE may promote (or limit) sociability among players, through affordances such as the interdependence of players, the integration of collaborative tasks, the integration of non-goal oriented, casual activities, appropriate communication and interaction channels.

b. The Designed Environment directs features of the Task: The environment presents the players with specific tasks and activities they may engage in. An example of such a task is the “quest”. Through the quests the players learn the game, practice the relevant skills and progress their virtual character. The format of the quests is defined by the environment: the requirements, the objective, the flexibility of the approaches and strategies a player may select, the rewards and the punishments. As Hämäläinen (Hamalainen et al, 2006) observed, players in a 3-D game environment would first attempted to individually solve the problems, before resorting to the help of other players. It seems, therefore, essential that the game mechanics not only encourage but rather require that the players engage in collaborative interactions in order to attempt certain tasks.

The quality and value of the rewards and the exploration of the game content through the quests seem to be the main motivators for the players. Many of our interviewees admitted that they wouldn't take up quests because the reward does not worth the time invested.

“I like doing the quests. Those silly ones that send you to talk to NPCs all over the map :D and which usually other players are bored of. [...] I like them because I like wandering around and seeing places in the game. Other people don't like them, at least in L2, because they don't give good rewards. And I like reading what every NPC says in quest – the story [concerning the quest]” (F 27, L2).

“If it [the quest] doesn't give you any money, I won't waste my time. [I would take up a quest] only for money or items” (M 29, L2).

The distribution of rewards (or loot as often referred to by players) among group members was another interesting point of study. Games such as L2 and World of Warcraft (WoW) integrate different mechanisms for the distribution of reward items and money among group members, randomly, by turn, or leaving the distribution to the judgment of the group leader. In MMORPGs, though, an alternative reward distribution method has been applied: the DKP (Dragon Kill Point) system, developed by players, which also considers the participation and commitment of the members. The distribution of rewards appears to be an opportunity for negotiation among members. In the excerpt from a video recording from WoW below, players distribute the rewards. They declare which item they need and they roll the dice (nicknames of the players have been omitted, for ensuring anonymity).

[Raid] [Umi...]: I want [Eskhandar's Collar]
[Raid Leader] [Del...]: [Shard of the Life Scale] roll

[Raid Leader] [Del...]: guys
 Le... rolls 63 (1-100)
 [Raid] [Ade..]: lol what a crap
 Ir.. rolls 79 (1-100)
 Ad... rolls 5 (1-100)
 [Raid] [War..]: I need [Onyxia Hide Backpack] and [Eskhandar's Collar]
 [Raid Leader] [Del...]: roll it
 War... rolls 27 (1-100)
 Le... rolls 24 (1-100)
 War... rolls 27 (1-100)
 Ire... rolls 85 (1-100)
 Lim... rolls 99 (1-100)
 War... rolls 31 (1-100)
 Lu... rolls 100 (1-100)
 Ad... rolls 50 (1-100)
 [Raid Leader] [Del...]: cmon guys
 [Raid Leader] [Del...]: roll for misin spes
 [Raid Leader] [Del...]: for things u ll need
 [Raid] [War...] I do need the neck
 [Raid Leader] [Del...]: who need that [Eskhandar's Collar]
 [Raid] [Ade...]: I don't need anything
 [Raid] [War...]: me
 [Raid][Lim...]: ME
 [Raid] [Ade..]: I pass
 [Raid][Lu...]: me
 [Raid] [War...]: I need [Eskhandar's Collar] the most
 Lim... receives loot [Onyxia Hide Backpack]
 Lim... receives loot [Book: Gift of the Wild]
 [Raid][Lu...]: WTF
 [Raid][Xpi...]: HEY ! :@
 War... receives loot [Eskhandar's Collar]
 Your share of the loot is 8 silver, 82 copper
 [Raid Leader] [Del...]: What did u do >:
 [Raid][Lu...]: CAN I PLEASE HAVE [Head of Onyxia]
 [Raid][Lime...]: I need [Head of Onyxia]
 [Raid][Moe...]: I nee too
 [Raid][Moe...]: [Head of Onyxia]
 [Raid Leader] [Del...]: [Helmet of Ten Storms] roll

More complex and open-ended quests or tasks, which can be approached through multiple strategies, seem to provide the potential for discussion, negotiation and strategy planning. One of our interviewees (M 26) insightfully suggested that when the tasks require a predefined strategy there is no motivation for the players to discuss, negotiate, plan and make decisions. They just go ahead and do the task.

Conclusion: Through affordances of the DE, in relation to the quests and tasks, such as the requirement for cooperation and organisation of more than one players, planning of the most appropriate strategy, motivating rewards, integration of the tasks into a meaningful narrative context, may increase both participation and interactions among players, as well as processes such as discourse, decision making, negotiation, and agreement.

c. Designed Environment affects the Group Structure: Specific functions of the DE seem to affect the structure of the groups, the roles, the responsibilities and the privileges of the members. In WoW, for example, members of a “guild” can be

classified as Initiate, Member, Veteran, Officer, and Leader. Officers and Leaders can add and remove players from the guild, Leaders can disband the guild and promote players to Officer, rename the existing ranks and create up to ten of their own custom ranks (The World of Warcraft website).

The role of each group member, in relation to a task, seems to be also directed by the skills and potential of the avatar, the number of members participating in the task, and the composition of the group.

“There are different things I can do with my char. For example, some time I only have to perform recharge to the main healer and no healing. Other times, I have to perform supporting heal. It’s not the same in every occasion, and it depends on where the party is. [...] It’s different to play, for example in HS with 2-3 people and different to play in Gracia with a full party” (F 27, L2).

“[...] your responsibilities depend on your class” (M 33, WoW).

In some occasions, group members may also define additional roles in the hierarchy of the group, roles that are not pre-defined by the game environment but rather emerge as a requirement of the group, as for example an officer for the maintenance of the group web site, or an officer for the management of the game events.



Figure 2: Screenshot from the interface of the MMOG World of Warcraft. A group consisted of five smaller groups coordinates for defeating a computer generated monster (by courtesy of one of our interviewees – nicknames have been blurred for anonymity)

The formation of the group also differs depending on the type of the group. In MMORPGs, more specifically, there are two main types of groups: persistent (such as “guilds”, “clans”, “tribes”, “corporations” as they are called in different games) and ephemeral ones (e.g. “parties”), oriented at a specific task or quest and disbanding after the completion of the task (see Figure 2 for an example of groups cooperating

for the completion of a task), with distinct qualitative differences between them. In ephemeral groups, members may not know each other and this decreases commitment of the members. As observed during our participant observation and the video recordings, members joining such groups would easily leave the group or dismiss a member with no prior notice, while participation in the group was mainly linked to the avatar role and the performance of the player. In the activity transcript below, from a WoW video recording, players, unknown to each other prior to the event, form a group through an integrated to the environment party matching function (transcript from the perspective of the participant to our study):

Activity

01. Player joins the party matching queue
02. Player enter his stats to the required fields
03. Player creates a party (the creator is the leader of the party)
04. Player looks for appropriate group members in the party matching queue and sends invitations to players
05. Players decline or accept invitations
06. Leader suggests looking into his friend list for finding more players for the party
07. A member leaves the party with no prior notice
08. The leader bestows leadership to another member, for inviting more players (only leader can invite new members)
09. Two members are leaving the party with no prior notice
10. Players offer to join the party, stating their role in the group, according to their avatar skills
11. Leader accepts offers for new members, based on their knowledge of tactics and their statistics (e.g. gear)
11. A player resets and consequently is removed from the party
12. He asks to be re-invited
13. Group leader does not invite him back to the party. He explains but they found another replacement for his position in the group.
14. The player complains.

In the transcript above leadership seems to mainly be a technical detail, and exchanged among players, depending on who wanted to invite more members to the group.

Conclusion: The environment affects the group structure through functions such as the minimum or maximum number of players for a group, the existence or not of a pre-defined hierarchy, the possibility or not for the players to define their own hierarchy structure, the communication channels available for the group, the privileges and actions each group member may do or has to do, the different types of groups the players may form.

d. The impact of the Designed Environment on the Members of a Group: From a motivational perspective, the complexity of the environment provides incentives to a variety of players. Bartle set the foundation for research on player motivation in MMOGs by proposing a typology of players: a) achievers, players interested mainly in attaining goals and accumulating valuable in-game items, b) explorers, players interested in exploring and experimenting with the environment, c) socialisers, players mainly interested in role-playing and communicating with others, and d) killers, players more inclined in acquiring weapons and cause distress to other players (Bartle, 1996). Features such as the graphical representation of the environment, the background story of the narrative, the variety of tasks appropriate for different types of players and preferences affect the players motivationally and

effectively, leading to what was described as “flow experience” at which state the players concentrate and are deeply involved in the activity (Csikszentmihalyi, 1992).

“[My main motivations for playing the game] are three. Graphics is the first reason. The second is the rich content and the background, a whole folklore binding the game, which gives you the perception that you are in a different world, with its own structures, organization, mythology, etc and the third and most important [...] has to do with the freedom of action [...] you can do from the silliest to the smartest thing; you are free” (M 29, WoW).

The avatars, the virtual representations of the players, seem to also have an impact on the in-game behaviour and attitude of the player. Indications emerged through our interviews, linking the selection of a particular avatar to the real life personality and attitude of the player:

“[...] and naturally, due to my personality and ideology, I selected a democrat character” (M 37, EVE Online).

‘[I was] in the Alliance. I had to be. As a mentality, though, I would rather be in the Hordes. But I had to be with the Alliance because my friends were also there’ (M 29, WoW).

“I initially liked them [dark elves] superficially, because they are prettier than the others! And the particular char I have, I think, suits me because it can do everything and nothing :D [...] [it suits me] because I am like this as a personality too; I try to help as much as I can” (F 27, L2).

The player and the avatar constitute a unit: the virtual character incorporates characteristics of the player’s personality and skills as well as the features, skills, and potential of the avatar. The activity of the player is channelled through and filtered by the affordances of the avatar –the skills, the possible actions, and the role of the specific avatar within the game ecosystem. Gee also linked the skills of the virtual character with the skills and knowledge of the real player in an effective unit (Gee, 2007, p. 77).

The relationship between player and avatar seems to be reciprocal. Yee and Bailenson (Yee and Bailenson, 2007) linked the representation of the avatar with the behaviour and attitudes of the players: taller or more appealing avatars increased in-game intimacy and self-confidence of the player.

Conclusion: Avatar representation, avatar variety, complexity of the gameplay, the narrative of the environment, accommodation of different player and playing styles seem to be some of the DE features that have an effect on the attitudes of the players. Although the above list is not conclusive, it provides indications of features of the DE that have an impact on the participation and engagement of the members, within the environment.

e. The impact of the Designed Environment on Group Interactions: In most MMOGs, groups have the possibility to communicate via exclusive channels through text or voice. Additionally to that, players in MMORPGs may interact through gestures and avatar actions. Availability of multiple communication channels seems to increase both group effectiveness as well as social links among members (Williams et al, 2007). Some of our interviewees also reported that they resort to voice communication to strengthen the sense of awareness among members.

From our observations and the processing of the video recordings, indications emerged that ephemeral groups which were more task-oriented, presented more task-orientated and instrumental communication and exchanged more task-specific information and less social chat, while in more persistent groups (such as clans, guilds, etc), sociability and social chat was part of the team's processes. Although this observation is not conclusive it provides indications that when achievement and the attainment of the goal is the main objective of the group, interactions among group members are mainly directed towards this objective. This distinction between game mechanics' goals and socially constructed goals was also discussed by Chen (Chen, 2008), who also made an analogy with school settings, where if learning is the goal and not the higher grades, then fostering of collaboration, shared-goals, relationships among students, and trust are essential.

In some cases, MMOGs divide players into opposing races or classes. Although this distinction promotes rivalry between these races, the sense of camaraderie is strengthened among players of the same race:

"It has to do mainly with the sense of team, and it's funny, because people that don't even know each other, with nothing in common except of the race, consider it as their duty to defend the new players being killed by someone else" (M 29, WoW).

Conclusion: The impact of the DE on the group interactions seems to be two-fold: a) through the interaction and communication channels available and their properties and b) through the requirements and objectives of the tasks and activities available to the players. Further research and empirical data on the impact of these aspects of the DE on group interactions would provide useful insights on ways through which meaningful and effective interaction among group members could be enhanced by the design of the environment.

f. The impact of the Social Environment on the Structure of the Group: As discussed in the section on the impact of the DE on group structure, players may also define their own hierarchy, in parallel to the hierarchy defined by the design of the environment. In ephemeral groups, as observed in the video recordings and our observations, leadership was not always a hard rule, but rather a technical detail, providing members with certain privileges, such as inviting new members. Such observations provide indications of the significance of the environment flexibility, so as to allow for player initiative and intervention.

Concerning the formation of a group, the significance of the social aspect came up in a number of interviews:

"When we were recruiting people [in our clan] we did not care about the class [of the player] but we would rather see how the other person behaves" (F 27, L2).

"I personally prefer to be in groups with people who communicate well, even if they are not expert players, rather than with "too" smart people, who don't miss an opportunity to exhibit how knowledgeable they are and how other people do stupid things and are to blame for all the problems of the team" (M 37, WoW).

“We form teams even if it’s not necessary. If, for example, a friend happens to play, we usually play as a team, just for being together, have fun and talk” (M 37, WoW).

“In my first guild there was no hierarchy, whatsoever. It actually was a company of friends. There is no leader among friends” (M 29, L2).

This is not the case, though, for every group. Groups, persistent or ephemeral, oriented towards performance, value the level and skills of the players more than the real life personality:

“In my guild, if you are not level 79, you can’t join” (M 29, WoW).

The social aspect seems to also come up in the assignment of roles in the group hierarchy. Although expertise and knowledge of the game is also considered, trust, reliability and commitment to the group seemed to be some of the main criteria for the acquisition of a higher rank in the hierarchy. Members that do not comply with the rules of the group, or don’t cooperate and communicate well with others, appear, through comments in our interviews, to be ignored, marginalised, or dismissed.

In many instances, it was observed in our video recordings, that in ephemeral groups, the dominant member of the group was not always the leader. In one of our recordings, the dominant member would confirm that other members were familiar with the tactics involved, would give directions to other players and even scorn bad performance, even though he/she was not the leader of the group.

Conclusion: Although group structure is defined, up to a point, by the DE, the SE, the features of the members, and the interactions and relations among them has an impact on the formation, the hierarchy, the leadership and the expected role of the members.

g. The impact of the Social Environment on the Members of the Group: Social interactions are among the main motivators for the engagement in an MMOG (Ducheneaut et al, 2006, Williams et al, 2007). The distribution of gameplay time between the tasks of the environment and socialising emerged as a trend from our interviews and the video recordings, consistently with Seay and co-authors’ study, where the social experience of playing has been reported by almost 40% of the players as the primary reason for playing (Seay et al, 2004).

“[the allocation of my time is] 50% killing and 50% talking. I would say that I like the online contact with other people; even if I play solo, I talk with friends all the time” (F 27, L2).

Other players may also constitute the audience for a player’s achievements and performances (Ducheneaut et al, 2006). Our ethnographic observations and our interviews indicated that in many occasions enjoyment and having fun with other players was more important than attaining game objectives.

The reciprocal relation between real-life player personality and skills and in-game avatar has also been reflected in our interviews, indicating that MMOG play transcends the objectives of the environment and approaches, at times, the functionality of a social networking environment.

“You see an avatar; a toon. Through this [toon] you reveal your real self” (M 29, L2).

“Instead of going out with my friends, I log in with my friends” (M 35, L2)

“[I login WoW] and I don’t necessarily play [...] some time earlier I logged in [...] and I didn’t do anything. Some friends were online and I was talking with a foreigner, I think he was Dutch” (M 29, WoW).

A number of players also reported in our interviews that MMOGs, except of their entertaining aspect, they provide the opportunity to meet people from different cultures, people of different personalities, attitudes, age, that would be difficult to meet in real life.

Conclusion: The SE the players and group members are situated in, has an impact on the behaviour, attitudes and motivation of the players. The virtual representation of the player combines features of both the avatar and the real-life player. Players are aware that they don’t just interact with avatars, but rather with other, real people, and this awareness has an impact on their behaviour and attitudes.

h. The effects of the Social Environment on Group Interactions: As indicated by our interviews and observation, social interaction and discourse beyond the objectives of the environment, socially constructed goals, relationships among the players seem to strengthen links and bonds among group members and the viability of the group (Chen, 2008).

“The most important factor that promotes the bonding is, I think, the so called guild chat. As you log in Warcraft in a dead hour, for example, when there is no reason for us to be there, there is no raid, you will see that there is conversation going on among the guild members, for any topic. [...]. This is what is called the social aspect of the guild. If there is no social aspect, most of the guilds, especially if for some reason there are no raids, when the guild master is offline or anything, the players start to leave the group. While a guild with stronger bonding will be preserved” (M 29, WoW).

Behaviour of group members also seems to emerge as a factor for the cohesion of the group; members that do not communicate well with others, as reported in our interviews, are marginalised or dismissed from the group, or inversely a group member may leave the group if the social interactions among members do not comply with his or her personality.

“I have seen once -and I remember that I had agreed to that- a member dismissed by the guild due to foul behaviour. He was extremely rude and offensive. He did not have any good manners at all” (M 29, WoW).

“a player may leave the group at any time. There is no punishment for that by the game. But it is considered bad behaviour if it happens at a time when the rest of the group needs him or her and has implications on future relations with the others” (M 37 WoW).

“I think that a good guild is defined by its behaviour after an epic fail! Ok, we were terrible, but it was just a bad day. No big deal” (M 29, WoW).

Conclusion: Interactions among group members seem to be significantly affected by the SE and the social relations in the group. Although, this is not a conclusive result, since the objectives and priorities of each group will have to be considered, it provides a field for further investigation.

Collaborative Problem Solving Processes are affected by the Task, the Group Structure, the Member Characteristics, and the Group Interactions: As discussed in the Introduction, collaborative learning, collaborative problem solving, and team learning behaviours are relevant to factors such as: the different forms and the quality of interactions and communication, the learning outcomes, the number of people involved, the environment, the interpersonal context and motivation. Through our discussion so far, we have referred to features of the DE and the SE that have an impact on these factors, through the design of the tasks, the structure of the group as defined by the environment or by the players, the behaviour and attitudes of players, and the interactions among team members.

More specifically, we have reviewed factors that increase player motivation and engagement in the environment, such as the social aspect, the narrative, the graphical representation of the environment and the variety of tasks and activities available. The environment may provide different channels of communication and interaction among players, such as through text (synchronous or asynchronous), voice, or avatar gestures, while a number of MMOGs provide increased opportunities for interaction among players, through casual activities, leisure in-game time or collaborative, task-oriented quests.

Although learning outcomes of MMOGs have not been documented, research in MMOGs has linked expertise to the performance of the player (Wang et al, 2009) as well as to the social capital acquired and the communication skills (Ducheneaut and Moore, 2004). During our interviews a wide range of answers came up in the question "What do you think are the features of a good player?", answers such as: "the one with the most extensive knowledge of the game", "the one who has explored the content", "the one who acts efficiently with respect to his or her gear", "the one with a good real-life personality", "the one with the best behaviour towards other players", "the one who reaches his or her objective more efficiently", "the one that plays for the game and not for winning". Players not only learn how to play the game according to the rules, but they learn how to play as members of a team, how to adapt their performance to the task and to the requirements of the group and the group members. The challenge for an education-oriented MMOG would be to combine the social skills afforded by the environment with domain-specific knowledge relevant to educational objectives. Learning the game and acquiring knowledge of its mechanics, is not a goal per se in such environments, but rather the means for improving and progressing the virtual character and for being accepted by the players' community. Similarly, the domain-specific knowledge relevant to educational objectives would be integrated into the environment and situated within a meaningful context.

The investigation of the multi-modality and of the complexity of MMOGs as environments of action and interaction seems to have revealed additional relations among the main constructs of our conceptual model. Additional relations seem to emerge among the tasks, the group structure, the member characteristics, and the group interactions. The structure of the group, the requirements of the task, the characteristics of the members and their roles seem to define the interactions in the group. As indicatively suggested by interviewees:

“the role of the leader is to direct the other members, what each one has to do [...]. If there is a SWS and BD in the party, they will have to cooperate for the buffs, otherwise the whole party goes wrong. The party leader will have to organise them. The other members should know their roles” (F 27 L2).

“it’s like in real life. People discuss. Each one may say their opinion. We talk, and the stronger players, the ones who play the game for longer and know it better, will decide” (F 22, L2).

Or inversely, the group interactions may affect the structure of the group:

“When there is a disagreement among group members, some members may leave the group; or the clan leader may dismiss them or even disband the clan” (F 27 L2).

For reflecting the interdependence of these factors we adapt our model as indicated in Figure 3 (m, n, o, p, q the additional relations):

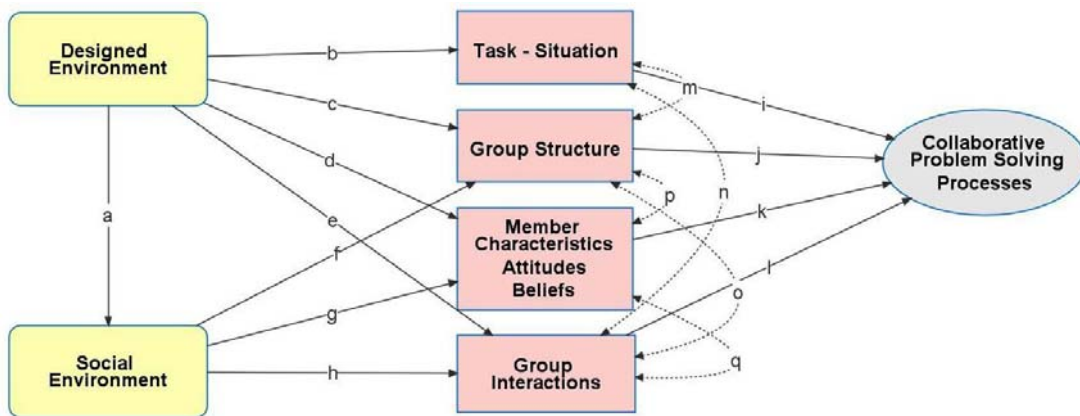


Figure 3: Conceptual Model of the Collaborative Learning Framework in MMOGs

CONCLUSIONS, LIMITATIONS AND FURTHER RESEARCH

Through this study we proposed a conceptual model involving the factors and processes involved in collaborative problem solving in MMOG environments. We investigated our data through the perspective of this model attempting to provide a qualitative framework of the collaborative learning emerging. Our findings and conclusions, though, are not conclusive, but rather indicative of emerging trends. In depth investigation of the relations described would provide valuable insights to the complex processes as they are shaped by the DE and the SE.

A next step for the development of our model -and possibly a challenging one- would be to investigate the relation between the collaborative problem solving processes and the construction of shared cognition with individual learning outcomes. An effective group and effective team learning behaviours seem to lead to the construction of a mutually shared cognition and individual learning (Bossche et al, 2006, Barron, 2003). Which collaborative problem solving processes emerging within an MMOG lead to the construction of new knowledge and the development of social and cognitive skills? Analysis of the interactions emerging, within the framework of collaborative learning, would possibly require an analysis framework where not only discourse but also actions and their relations with the actions of other players would be considered (see also Suthers et al, 2010).

Our study was mainly motivated by the appeal of MMOGs on millions of players. World of Warcraft alone -one of the most popular MMOGs- reached a population of 11.5 million subscribers in 2008 (MMOData.net). Successful MMOGs have managed, through their design, what seems to be the goal of most collaborative learning environments: engagement and commitment of participants and the development of social and cognitive skills. Understanding of the processes that not only engage players but also scaffold progress in the environment and the acquisition of skills may provide valuable insights for the development of innovative learning tools, appropriate for the requirements and expectations of the new generation of students.

NOTES

1. xp: gaining experience points in the game, through killing computer generated monsters (mobs).

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