Virtual Team Interactions in Networked Multimedia Games
Case: "Counter-Strike" – Multi-player 3D Action Game

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ABSTRACT

This paper describes the findings of the ethnographical research concentrating on multiplayer games. The overall goal is to study the interaction in these networked multimedia environments. The focus is in finding out how the player teams interact and whether the current games provide enough possibilities for team interaction, either inside the game world or supported by real world communication. The research methods used are qualitative. The end-users were interviewed using open-ended and semi-structured interviews and the game playing sessions were observed. The main objective is to acquire general understanding of team interactions in the context of the research. The preliminary analysis indicate that, according to the players, the support for team interaction in action games is adequate. However, the players tend to communicate outside the game system. Furthermore, the players tend overcome the limitations of the systems by inventing various imaginative ways to communicate, co-ordinate and co-operate. This indicates that there is a need for additional interaction support. Especially the more serious team-oriented tasks seem to require seamless multi-modal interactions to guarantee the success of the team.

1. INTRODUCTION

The aim of the research is to provide more understanding on the interaction in Networked Virtual Environments by observing the interactions that occur in networked multi-player games. The underlying approach selected for the research work is to find ways to utilise entertainment industry solutions (e.g., games domain) in other application areas, such as distribution support or Computer Supported Co-operative work (CSCW). Based on this approach, the empirical part of the work concentrates on issues and concepts relating to networked multi-player games.

There have been relatively few occurrences of game-related research, or work based on solutions of entertainment industry, within today's academic world. Apart from the game theory and corresponding research fields, the social norm of traditional sciences seems to neglect the aspect of games. Fortunately the current trends are changing and it is already possible to find research papers discussing the diverse aspects of games (e.g., architecture, media, AI, development process, market trends, learning, and social behaviour).

The increasing importance of games and game industry has been discussed by several researchers. An indication of this matter is brought forward by Nunamaker (1997) who points out that the importance of games in the future of virtual reality collaboration may be seen in the marketplace for games and for publications about them. The game field is converging with the traditionally research-oriented areas by providing a set of concrete applications and phenomena to be studied. On the other hand, the virtual environments constructed by researchers have also become a new medium for entertainment services such as games (Lu et al. 1999). The increasing amount of similarities makes the study of networked multi-user games as an important area of networked virtual environment research.

Bowman and Hodges (1999) point out that the current applications within entertainment sector do not usually require complex interaction between the user and the system. Although the user may be interacting frequently, the interactions are mostly simple in nature. This may lead to the conclusion that interaction is a major reason for the lack of real-world usage of more complex applications, thus, suggesting various research topics for the areas of human-computer interaction and computer-mediated interaction. For example, the enabling nature of *rich interaction* (i.e., interaction set consisting of a large number of individual action and interaction types and possibilities that allow highly complex interaction sequences) and the corresponding benefits to the users can be considered as an interesting area for further research.

The research methods used in the work are qualitative. The players were interviewed using open-ended and semi-structured interviews and the game playing sessions were observed using ethnographical approach. The main objective of the interviews and observations is to acquire more understanding on team interactions, in order to find ways to apply this knowledge to CSCW applications.

Due to its interdisciplinary nature, the research area can be analysed against several frameworks coming from various sciences. The scientific frameworks beneficial for studying various aspects of interaction include CSCW, Communicative Action Theory (Habermas 1984, Manninen 2000), Maslow's Hierarchy of Needs (Maslow 1970), and various action, interaction and communication theories.

This paper being part of the larger research activity focuses on analysing virtual team interactions in multimedia games. The main research problems can be formulated as follows:

1. What is the role of interaction and team interaction within current multimedia games?
2. Do games support the real life like interaction, which includes high amount of ambiguous and tacit actions that generally have been difficult to implement in computerised settings?

In order to understand the scope of team interactions in virtual environments, the modern networked multimedia games have been studied. One reason for this kind of approach is the generally different nature of game settings in comparison to traditional CSCW applications. The relevant question at this point is whether the highly focused and problem-solving oriented games domain provide larger understanding towards team interaction, or are the basic patterns similar and only disguised on a different set of "clothes"?

The starting point for this work are the various games that contain a degree of teamwork, either forced by the game plot, or arranged voluntary by a group of players. Traditionally, the role-playing games have been falling to this category, although many of them provide fellow team members as computer controlled constructs. More recent games domain is the networked 3D-first-person-view fighting games such as Quake and Unreal, which provide somewhat natural possibilities for teaming-up with fellow players.

The secondary objective of this work is to create a set of core requirements for future networked multi-user virtual worlds in terms of degrees of freedom to select and use adequate action and interaction types. This author thinks that by analysing a large enough set of interaction features in games domain, the received insight could then be applied in other application domains as well. The team aspect provides possibilities to exploit these ideas and findings in various virtual enterprising and team training scenarios. Furthermore, the area of computer supported learning and training could benefit from innovative ways to organise and run team-based exercises.

2. VIRTUAL ENVIRONMENTS

The modern multimedia games are very similar to the Virtual Environments (VEs) developed for other application domains (e.g., research, military, and training). VEs, just like games, provide another means of simulating real or imaginary world places and activities. A VE is computer-generated simulated space with which an individual interacts (Witmer et al. 1996). Further definition and expansion of the term is provided by Singhal and Zyda (1999): Networked Virtual Environment is a software system in which multiple users interact with each other in real-time, even though those users may be located around the world. According to Singhal and Zyda (1999), a Net-VE is distinguished by the following five common features: a shared sense of space (illusion of being located in the same place), a shared sense of presence (avatars of participants), a shared sense of time (real-time interaction possible), a way to communicate (various interaction methods), and a way to share (dynamic environment that can be interacted with). Figure 1 illustrates the five common features of Net-Ves.

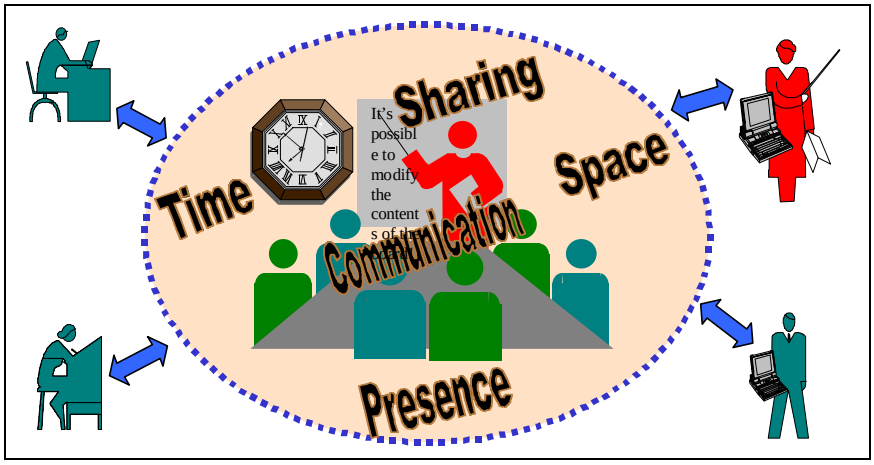

Figure 1. Five common features of Networked Virtual Environments.

VEs such as 3D computer games convey information about real world places effectively because they tend to preserve the spatio-temporal aspects and natural modes of interaction characteristic of real world environments. In many applications the core activities revolve around spatiality and other aspects implemented in the virtual representation of the environment. In addition to real world places, VEs can be used to represent non-existing or inaccessible physical spaces, or to represent abstract or non-physical

concepts (Witmer et al. 1996). This applies especially within the games domain due to the fantasy, imaginary and unrealistic elements of many games.

3. VIRTUAL TEAMS

In the context of this paper, the term Virtual Team could be defined, at least in a broader sense, as distributed team. This means that usually the team operating in multi-user game world is formed by individual human players accessing the same virtual environment from different physical locations. According to Pascual et al. (1999) a distributed team is one which is geographically dispersed to a greater or lesser extent, such that the team cannot have direct face-to-face contact with each other for significant parts (possibly the whole) of its operational activities. The field research setting described in this paper includes virtual teams that have temporally been co-located within a same physical hall. In this sense the virtuality of the teams may not be fully achieved.

When considering either traditional or virtual teams, the most distinctive team activities seem to be related to communication in one form or the other. Figure 2 illustrates some of the sample structures of team-based communication networks. The basis for the models come from (Wiio, 1978). In the field of game applications such as the one described in this paper, the usual team-based communication network is more or less democratic (i.e., the ring), although there are several occurrences of leader centric approaches. The leader centric model, however, is mostly based on free-will implementation, and thus, is not necessarily supported (or forced) by the system.

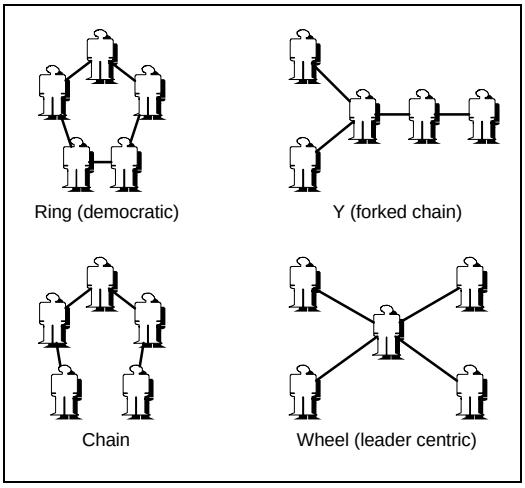

Figure 2. Example structures of team-based communication networks.

The virtual team interactions follow the routes of computer mediated communication. The virtual environment, i.e., the multimedia game setting, provides means and context for interaction, and also limits the possible choices to interact. The contextual part in games tends to direct the quantity and importance of inter-personal communication. For example, the role-playing games with their more intrinsic social and communicational structures, lead the game play to a quite different direction than the fast paced action games with less talk and more deeds.

Virtual teams have been noticed to have several problems in the distributed work settings. Although this research focuses on games domain, it is important to identify the major problems, in order to compare the entertainment settings to the various other fields. Pascual et al. (1999) have identified five major problem areas within distributed team interaction in the context of military teams. These areas are communication, situation awareness, leadership, core teamwork behaviours (e.g., monitoring, feedback and support) and training. The foundational role of these areas makes them applicable to numerous virtual team settings, and especially to the one studied during this research.

Nunamaker (1997) explains that a severe problem all distributed sessions have encountered has been the difficulty of getting members to participate and then maintain their engagement over time. He feels that this is key to engaging individuals in the process and maintaining the level of effort over time. Different groups will require different incentives and have different vested interests. Team-based incentives and rewards stimulate peer pressure from within the group. Co-operative incentive structures reward individual group members based on the performance of the group. These structures can lead to co-operative behaviour, i.e., participation and co-ordination of effort among two or more individuals. This is particularly interesting within team games that require the contributions of each individual in order to accomplish the task assigned to their team.

4. INTERACTION TAXONOMY AS FRAMEWORK FOR ANALYSIS

The following section presents a tentative taxonomy of interaction that has been created by this author to serve as a conceptual model, in order to have a framework for analysing the research material. The taxonomy has been constructed by collecting theoretical and empirical material (video recordings, interviews, walkthroughs, observations, and heuristic evaluations) from networked games and game events and from self-arranged gaming sessions. A total of twenty games have been studied and the material has been expanded with heuristic evaluations of a number of Net-VE applications.

Figure 3 represents the first layers of the decomposition that forms the proposed taxonomy. Further decomposition and additional details concerning the model can be found from other publications by this author (Manninen 2000 & Manninen 2001). The map illustrates the main interaction types that can be found within the current multimedia games. The basis for this taxonomy is the categorisation of various interactions in terms of purpose, context, and acting entities (e.g., body parts, fellow team members, etc.).

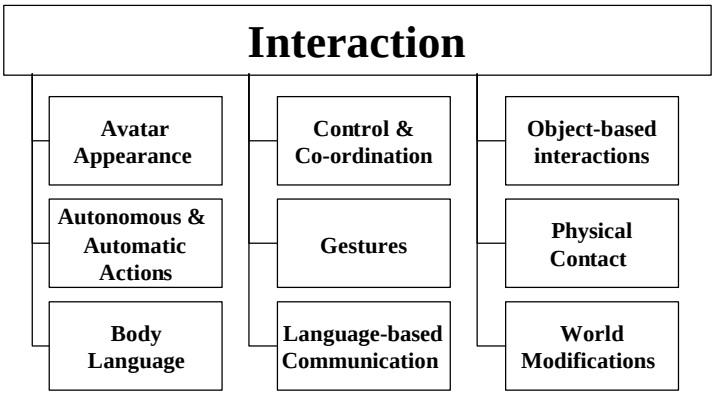

Figure 3. Taxonomy of interaction types in terms of top-level categories.

The conceptual model is not finalised, but is merely improved and modified iteratively after individual research tasks. All of the concepts are not directly applicable to this work while the material under discussion in this paper may reveal some additional concepts to be included in the taxonomy. The main categories found in the model will be used as basis for the analysis.

5. RELATED WORK

There are several areas in the world of games that can be considered as academically interesting. For example, the interpretations of the game theory can be of important value when studying applications within the field of computer games. For example, Stalnaker (1999) provides insight that reveals the basic issues behind games: “The games that game theory studies are for the most part dynamic, interactive situations. The rules of the game define a sequence of choices by different players who may react and respond to the choices previously made by others, and may base their choices on their expectations of the effects that they may have on choices later made by others.” Although this interpretation is relatively general, it can be adapted to modern multimedia games played real-time by several simultaneous users.

One interesting aspect of team interaction is the possible selection of amount of interactivity a player is willing to have at any particular time. This means that a group member may decide to take a more passive role in his or her game-play, and thus, allows the leader (or other team member) to do most of the interactions. The “passive” player takes the role of an observer who, instead of watching pre-produced “film” as an outsider, is following the actions of his or her team in real time. The player may even have a possibility to connect the actions of his or her avatar to the one’s of the team leader, thus making it easy to actually follow the leader within the virtual environment. According to NRC (1997), the systems and environments should be designed in a way that at any point in time when a user takes an interest in particular portion of the information, he or she will be able to begin interacting with the system (and with other users if applicable). Multi-user domains (MUDs) are one example of environments where an individual can take the role of passive observer until such time as he or she feels more confident and wants to step forward and participate more actively.

Interactivity is the extent to which the user feels convinced of the mutual effect that he or she and the environment have on one another. Better interactivity produces more pleasing, better-controlled interaction with the virtual environment. Level of interactivity is a function of the speed of response, the range of possible user interactions and the mapping of controls (Nunamaker 1997). Rapid response time promotes

interactivity by providing immediate feedback to operations performed by the users. Action games like Quake represent the highest level of interactivity attained so far, achieved by pushing I/O devices to their limits. The number of choices that a user can make at any point in time reflects highly to the range of communication technology. Within the application domain of multimedia games, this dimension of interactivity level function is generally dominated by role-playing games and simulators. The third dimension, mapping of controls, is the relationship between the user's physical interactions with the input mechanisms and the changes to the virtual environment. Due to the limitations in user interfaces, this seems to be one of the major problems standing in the way of achieving high level of interactivity. Fast response action games and simulators are currently operated through keyboard and mouse, thus requiring complex key mappings in order to provide access to all of the actions.

While the early prototypes of multimedia games suffered from both user interface and communication limitations, they still were able to provide meaningful interaction. Improved graphics rendering and server crowd control speed would reduce the effort required to approach other players for interaction. Further exploitation of auditory features (speech and interaction cues), would greatly reduce the confusion and improve the usability. There are also limitations that prevent the full expression of interaction, for example, because avatars are not unique to each user, it is difficult to distinguish between strangers and familiar users (Damer et al. 1996).

6. ETHNOGRAPHICAL FIELD RESEARCH

The empirical material for this research was collected during Vectorama 2000 LAN gaming event held in Oulu during June 9-11, 2000. The event was organised by Vector ry, the Network Gaming Association of Finland. The target group for the event was people over 16 years of age that were interested in playing multi-player games. The players with their personal computers were all gathered within the same hall. The layout was organised in a way that one person could not see more than one or two additional monitors thus limiting the visual flow outside the game environment. Furthermore, the players were using headphones to increase their sensitivity to contextual audio information and to supress the constant outpour of background music provided by the organisers.

The number of participants was over 40 (the average age being around 18) with the team sizes ranging from 3 to 8 members. The games played during the event were selected according to players' wishes. The Half-Life multi-player modification Counter-Strike (CS) was the top choice, thus, corresponding to the fact that CS is one of the most played action games on the Internet at the time.

The game is very realistic when compared to the regular Unreal/Quake "*deathmatch*" games, and players really have to work in teams and think what they are doing to achieve their goals. Counter-Strike can be best described as a "light-weight tactical combat simulation". It modifies the multi-player aspects of Half-Life towards more team-oriented game play. Each team has access to different guns and equipment, as well as different abilities. Game locations have different goals such as: hostage rescue, bomb defusing, terrorist escape, etc. Weapons include the usual assortment of pistols, shotguns, rifles, grenades, etc. CS is quite unlike any other action game - it has a very unique and intense atmosphere, which adds up to the game play. More information regarding the game is available at the official Counter-Strike web site (http://www.counter-strike.net). Figure 4 illustrates an example game environment setting (on the left) and the appearance of two characters (on the right).

Figure 4. Screenshots illustrating scenes from Counter-Strike.

Since Counter-Strike is a quite realistic military action game, it was interesting to see how much players tried to implement real-life tactics in the game as seen from the films and TV. However, it was not expected to see any tactical meetings before the games – that is not the general idea of fun in a gaming event like this - but some co-ordinated team efforts were anticipated since CS is a team game. Other interesting area of research was communication during the games: how much text communication was used and did it affect in the game play? Also, since players were in the same room during the game, the amount of vocal orders or instructions were observed.

7. ANALYSIS

The material collected during the observation session was limited to one game application, because most of the players stayed within the same game system during the event. On the other hand, the research provided plenty of material related to Counter-Strike. With the future work focusing also on different type of games, the material collected provides adequate starting point for the work. The total amount of material videotaped during the event was 17 hours consisting of descriptive general pictures and more detailed screen illustrations.

7.1 Virtual Team Interaction Examples

The following section describes some of the sample findings in relation to virtual team interactions during the observed gaming sessions. Some of the examples are selected from the video recordings while others have been formulated from player interviews. The cases have been selected from the raw material based on their occurrence, importance, and level of interest in terms of this study. The descriptions are categorised according to the components of the interaction taxonomy.

Avatar Appearance, in this game, seems to play a sort of double role – on the one hand it provides visual information to other players, and on the other hand it allows the players to have different roles in the game. The *posture changes* of the avatar during various actions, both conveys the act to others within vicinity, but also provides possibilities to access, for example, an advantage over the opponent. The kneeling behind a crate, or other object within the environment, is one typical way of seeking cover and gaining an element of surprise. The *visible outlook* of the avatar is limited in terms of size and other features (team has similar type of outfits), but there is some amount of variations available to the players. The active weapon is also visible to others, and thus makes it possible to estimate the range, speed of fire, and other characteristics of the opponent. However, the effectiveness of this visual information seems to be rather low due to the average firing distances. If the player sees an opposing team member, there is either very short time to react, or the opponent is too far to be observed in detail (except with telescope, which is also available for certain weapon).

Autonomous & Automatic Actions play an important role in terms of game-controlled features. The most common actions revolve around injuries – the overall performance of the avatar is affected by the level and location of his or her injuries, which cause certain amount of bleeding (visible to others) and restrictions to movement (limping, etc.). When the amount of injuries exceeds the critical level, the avatar falls down and the player is transferred to the observation mode and is, thus, out of the game.

The self-programmed actions, or auto actions, which are acceptable in certain games, are highly discouraged in this community. These programmed enhancements of playing performance seem to cause major problems in Internet gaming in the form of cheating. The player community values honest skills in terms of accuracy and speed, so especially the team matches are very strongly self-controlled.

Body Language seems to be rather insignificant in this game with the most common occurrences being merely slight additions to the overall atmosphere. The fast pace of the game does not leave too much time to observe these non-verbal cues, not to mention the difficulties in providing adequate means to users in controlling their own avatar expressions. However, one area where body language is widely implemented is the group of injury related expressions such as grins, heavy breathing, etc. Supposedly the players are not too interested in having stronger expressions and much rather treat the avatars as pawns in the game.

Control and Co-ordination related interactions seem to form the major part in Counter-Strike, which is quite obvious due to the game's orientation towards team tactics. Most of these interactions are more or less voluntarily played-out by the teams, so the game system is not forcing too much in these matters. Of course, the exploitation of synchronised and co-ordinated tactics seem to provide better overall results in the game, as opposed to the team of solo players. One clear example of co-ordination is the programmed feature, which makes the individual game rounds start on a pre-set time, so the players have time to equip themselves. The end game is usually determined by one of the several winning factors, such as rescuing all of the hostages, defusing the bombs, loosing every team member, or encountering the time out.

Creating a diversion is tactically one of the most frequent form of interactions. Diversion is created, for example, when a major force attacks straight on while other team members circle around to surprise the opponent from behind. This type of activity is strongly related to the layout and familiarity of the environment. If the teams are experienced players, the element of surprise seems to be rather non-existent,

because every player knows every single advantage point of the environment. This may be one reason that has lead to the highly developed playing routines, such as common tactics, specific roles of team members, and order of actions – in the extreme the game session gives out the feel of observing robots doing their tasks.

Real-life tactics are applied, but only to a certain degree, so the players do not tend to replicate the real world actions to the finest detail. The team may have informal briefing sessions between the game rounds, but mostly the actions of individual player are co-ordinated by adapting to the actions of others - both friends and foes. The self-evident aim of the game sessions is to have fun, so the detailed manoeuvring and playing by the book seem to be less favoured. Still, the game rounds are usually won by the teams who utilise some sort of co-ordination.

Movements of the individual players, or the group of team members, are usually related to various strategic actions. The attacking player may be jumping up and down while running, in order to avoid the fire of the enemy. Also, the accuracy of own fire may be enhanced by standing still, or kneeling, while aiming – this applies especially to the long-range weapons such as sniper rifle. Otherwise, the performance is very much dictated by the speed and accuracy of player's motor skills, although with relevant co-ordination the team can increase their changes in attacks, ambushes, and defences.

Gestures are perhaps one of the most requested types of interactions among the action gaming community. The players would like to have more possibilities in signalling various messages with their avatars. Currently, the game system does not support these types of actions very well, so the players have invented their own workarounds to overcome the communication barrier. One very clear example of gesturing is pointing the direction with weapon while moving back and forth with rapid movements. This action can be used, for example, to tell a fellow team member to divert and check the location within the pointed region. In addition to this type of gesturing, there are several occurrences of using grenades for pointing a direction, or just for indicating one's position to a fellow team member.

Language-based Communication is mainly managed with predefined voice messages and text-based chat channels. The cries for medic, needs for backup, enemy sighted, and team status reports are the most common messages filling the audio space of the game environment. The textual chatting is an additional form of exchanging information, but due to the typing seems to be less used, at least during hectic action. Actually, the chat channel seems to be crowded with non-contextual data, such as players taunting each other in general, complaining about the network delays, or just exchanging experiences with others. The contextual messaging is mostly used to provide information not supported by the predefined voice messages, or to add some relevant data to these.

One major issue observed during the gaming event was the amount of out-of-game communication over the computer screens. The players were able to hear each other even with the headphones on, so there were plenty of examples showing the importance of the social aspect in games. The players got excited, were frustrated, tried to get their acts together, or just laughed out loud during the game rounds. In this form the computer gaming seems to come very close to the traditional games with their strong social importance and feeling of togetherness. Of course, this type of interacting is only possible when the players are actually in the same physical location, so when considering pure networked gaming with isolated players, there are quite big differences. The lack of natural communication has been approached with third-party software providing voice-over-IP messaging, but still the player community favours the LAN parties in terms of making best out of the games.

Object-based Interactions consist mainly of handling various weapons, ammunition, armour, and other equipment. The players purchase their set of equipment in the beginning of game, so the amount of fire power, etc., is somehow limited to maintain the balance. The combination of different weapons and corresponding player roles (e.g., sniper, close-range, rapid fire, grenades) bring a sense of role-playing to the game, and also provides more variations in terms of tactics and playing styles. Otherwise, the interactions concentrate on possible weapon and ammunition exchange with other team members, and reloading the weapon when needed. Tactically the selection of weapon, the time of reloading, and also the use of grenades affect strongly on the performance, so in this sense the objects and their management play an important role in this game.

Physical Contact is clearly an important type of interacting in this kind of fast action fighting game. The level of violence in general is relatively high due to the mainly *aggressive* interactions. Shooting, stabbing, and blowing-up are the main actions to get rid of the opposing team. However, the game is not chaotic *deathmatch*, because the added winning factors bring in another aspect of team playing. There are no direct alternatives to violence, except running away or hiding. The game system does not support any form of blocking, or otherwise *defensive* contact-oriented actions. The few examples of non-violent contacts include freeing the hostages by touching them, and standing in the way of other player and thus blocking his or her route.

World Modifications are generally not supported by this game, although some of the environments contain windows and doors that can be destroyed. The main reasons for this type of activities include getting an access to another place, or increasing the level of visibility towards the presumed attacking

direction of the enemy. Of course the changes in the environment can also give a hint to other players suggesting there is, or there has been, someone near the broken element. In addition to breaking, there are also doors that can be opened and closed, and even locked. Apart from these, there seems to be no major examples of modifiable elements of the environment.

7.2 Discussion and additional findings

The Counter-Strike has been clearly designed to encourage team playing, although there are plenty of solo-players who may be almost invincible. The combination of different weapons and roles, added with environments that provide plenty of challenges for communication, co-ordination, and co-operation, seem to create intriguing examples of team interactions. Furthermore, the teams tend to regulate their own social norms, which is most strongly visible in the clan structures and hierarchies. Unfortunately the team play is only as good as the weakest link, so there are several examples of differences in playing styles causing spoiled gaming experience, or even outright fights.

One major finding was the fact that players really do invent their own form of communicating, even when the game genre in question is not very strongly communicative one. Especially, the LAN gaming sessions indicate the need for strong social togetherness, and thus, are often the venues for the strongest experiences. It seems to bring great satisfaction for a player when he or she has successfully out-performed the opponent, and the can actually see the opponents reaction in the real world. In addition to this, the teams seem to have as much fun discussing and arguing about the game between the rounds. The after-match interactions are at least as important over here than in any other team sport.

According to the analysis, the players were relatively satisfied with the game and the team interaction support. When playing for fun, without any greater goals, they gave no or very little instructions outside the game. The players simply played observing what others did and built their own strategy to meet the needs of the team. No strategies before the game, no analysing afterwards.

An additional interesting finding was the increase of interactions when the significance of the game increased. There was clearly a strong correlation between the amount of team interactions and importance of the game. In the team playing tournament the players really tried to help their teams by organising their actions and by communicating over screens. This indicates that even though the players say that they do not need any more support for team interaction, they would use it if it were available. Furthermore, the seriousness of the task seems to enforce the need of multi-modal interactions.

When interviewing the players, arguments about the missing speech support were contradictory. Many of the players said that when using third party speech software (e.g., Roger Wilco), the players usually shout all at the same time and there is no control in the communication. Some of the players would have wanted built-in speech support and believed that the teams would eventually learn to use it in more controlled fashion, especially if the audio was spatial and modelled according the environment.

It was relatively surprising to see how little the team members actually communicate in the middle of the game rounds. The players have obviously played so long that they do not actually need to say or hear anything, they just observe other players and know what would be the best place to be in. This can be a result of an adaptation process – in a way the feeling of presence has been enforced by the familiarity of the environment and missions. If the situation was to be more realistic, people would possibly interact with each other in many different ways, i.e., hand signals and short words. Since it is impossible to write, control your avatar, and shoot at the same time in the current games, people decide to keep themselves alive instead of chatting with each other. Another issue is the limited hand signals and other non-verbal communication available in today's 3D games.

It would have been beneficial to have different games from different genres to study and compare. Still, the large amount of material collected during this research provides an insight to the interactions that occur inside (and outside) of one of the most popular action games available today.

8. CONCLUSIONS

The biggest surprise of this research was the level of satisfaction the players felt with the networked games they play. No major improvements to the game were brought up, even though the players spend a large amount of time playing these games. Either the games are close to perfect, or the players are too good in adapting to the application and environment in question. Of course the nature of the application domain helps the adaptation process in terms of high motivation levels. Furthermore, the suspension of disbelief seems to be the general phenomenon in entertainment domain, thus creating enhanced feelings of presence for the players. In this type of setting the users do not necessary require realistic implementations, but instead they are willing to believe to be part of the imaginary world.

According to the material collected during this research, the support for team interaction in action games is adequate. However, the players tend to communicate by giving orders and information outside the game, over their screens or by using third-party software. This indicates that the players would like to have some additional interaction support as well. Majority of the players observed during the research were

experienced players, who generally tend to adapt to the complexities and limitations of the systems. The findings suggest that especially less experienced and novice users would benefit from the richer set of interaction possibilities.

The main implications for design, provided by this work, are not necessarily technical ones. The amount of bandwidth and communication channels may help of course, but the main task is to balance the system using artistic selectivity and principles of game design while creating team-oriented applications. The designers of these environments could really learn from the field of entertainment and game industry, but also from the conceptual work and theoretical models of interaction. The need to understand the concept of interaction in these networked virtual environments seem to be highly relevant if we want to construct rich experiences for the users.

This research is a starting point for a further voyage to the research of networked gaming. First task is to further analyse the material gathered, compare that to other game genres, and to get a good overall picture of the games and corresponding settings. After the study of additional gaming events it is possible to get a relatively good picture of team interaction in various networked multimedia games.

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