Stimulating Massively Multiplayer Cooperation with Co-located Game Concepts

Laura Dietz
Fraunhofer Integrated Publication and
Information Systems Institute (IPSI)
Dolivostrasse 15
64293 Darmstadt
++49 6151 869 961
laura.dietz@ipsi.fraunhofer.de

ABSTRACT

Nowadays, since problems get more complex and require large interdisciplinary groups, successful teamwork gets more and more essential. A prerequisite for teamwork is cooperative behavior of the team members. In this paper we examine how cooperation can benefit from games and what characteristics these games should embody in order to increase cooperative behavior in a business context.

We sketch how these games can be implemented for very large co-located groups using the software Digital Interaction System. Furthermore we examine different elements that were introduced in Digital Interaction System to support the application domain of moderation and how these elements contribute to innovative game concepts in general.

This paper presents concepts for a trading game and a virtual ball game as examples of games for very large co-located groups that embody elements that are the basis for cooperative behavior.

Categories and Subject Descriptors

K.4.3 [**Computers and Society**]: Organizational Impacts – *Computer-supported collaborative work.*

K.8.0 [**Personal Computing**]: General – *Games.*

H.1.2 [**Models and Principles**]: User/Machine Systems – *Human information processing.*

General Terms

Human Factors.

Keywords

Game concepts, co-located CSCW, social implications, mixing games and business applications.

1. INTRODUCTION

Games are often used to break the ice and strengthen team spirit within a group. This is especially important when a for example when the upper management of a large distributed company meets once a year.

To support these kinds of events, Fraunhofer IPSI has developed the software Digital Interaction System. Since we started our work with applications in the facilitation domain, Digital Interaction System is also referred to as Digital Moderation. The project began in September 2003 and the first version, which is designed for 1000 persons and tested with 150 participants, was deployed in August 2004. It came into operation the first time at the European leadership conference of a large international company in October 2004. Up to now, Digital Moderation supports the work process by implementing moderation methods known from Metaplan® [12] and simplifying aggregation of results and different media, and can be integrated into the company's workflow. On this basis, new facilitation methods, which emerge from the options provided by computer support, are going to be created soon. Furthermore, we are currently examining new application areas like agenda driven meetings, cooperative learning and - as a key technique to all of the above - gaming.

Figure 1. Participants walk around and discuss different solutions.

Independent of the application domain, the situations we aim at have the following in common:

- A large group attends the meeting, where not all participants know each other well.
- It is a co-located meeting, i.e. all participants are at the same place.
- People are going to cooperate tightly with each other in order to achieve a common goal.
- The achievement of objectives requires a highly social process, where direct face-to-face communication is an integral part.

In this paper we examine game concepts that suite for stimulating cooperative behavior and that take advantage of massively multi-user co-location, where computers are available, but not in the main focus.

In the next section we recapitulate related work in the area of pervasive, collaborative and conventional games and discuss to what extend they match our objectives. The software Digital Interaction System is described in section 3. Section 4 examines new game concept that can emerge from our scenario as well as how business application can benefit from games. Sections 5 and 6 discuss two game concepts that fit according to our requirements. The first example employs a classic, straight-forward concept and the second example is a visionary idea. Section 7 finishes with conclusions, next steps, and open research questions.

2. RELATED WORK

In this section we examine how the related work contributes to games that stimulate cooperative behavior and can be applied to a large group of people located at the same place. We identified the following three main categories: pervasive games that embody cooperative elements for small groups, pervasive games for large groups, but without focus on cooperation, online games for medium sized cooperating groups and non computer-mediated games for larger groups.

Much effort in the research area of pervasive games is focused on games that emphasize face-to-face communication like augmented tabletop games (False Prophets [11] and Pervasive Clue [16]), wireless "people move around and interact spontaneously" games (Pirates! [1]), or cooperative puzzles like Geney™ [3]. Although they all contain cooperative elements, they currently do not scale well to a large (e.g. 150) number of players.

Mixed Virtual Reality Games [2] and PDA based games [6], where the real world is the virtual game board, scale well, but face-to-face communication is sparse and tight cooperation within larger groups occurs rarely.

Massively Multiplayer Online Role-Playing Games like Everquest [5] support tight cooperation in groups, but in most cases a player cooperates with the same ten people over a long period of time. Since it is an online game, communication between players is fully computer-mediated.

Online cooperation in a medium-sized group (approx. 30 participants) is possible in an online game described by Eisenstadt and Vogiozou [18]. Their game BumperCar allows participants to tailor their own rules which allows the group to experiment with different kinds of cooperation.

Holliday makes some suggestions on how to turn a multiplayer game into a massively multiplayer game [7]. For most games this would result in dividing the group into subgroups and play a tournament, because many games embody turn-taking mechanics or have a limited board size (e.g. Ludo). But this results in many small groups playing a cooperative game, without large-scale interaction.

On the other hand, there exist some games that allow face-to-face cooperation within a large number of participants that are not augmented with computer support. For example Massive Multiplayer Thumb-Wrestling [13], a concept of the Austrian artist club Monochrom. They describe several ways on how to make the classic one-on-one game Thumb Wrestling a multi-user experience.

Special kinds of Role-Playing Games, where people meet and masquerade are called Live Action Role-Playing Games. Some variants, where players re-enact a war scenery (e.g. [17]) can be attended by approx. 150 players.

In the area of Massively Multiplayer Games, little work has been done besides the trail of Role-Playing Games. There exist some pervasive game concepts like Pervasive Clue and Pirates! that can evolve into massively multiplayer co-located games, although designed for a medium sized group.

3. DIGITAL INTERACTION SYSTEM

This section presents a software that was created to support large-scale group work. It describes how the software can be extended in order to examine the implications to the area of games in section 4.

3.1 Application Domain: Moderation

The software Digital Moderation (as Digital Interaction System is called in the application domain of facilitation) supports moderators in facilitating co-located events with a group size of 150 (currently tested) up to 1000 participants. Conventional facilitation methods like Metaplan® [12] that utilize packing paper, adhesive dots and hand written cards, are very difficult to use with more than thirty participants. Then, the organizational overhead gets very large and the facilitator is distracted from moderating the group process. In Digital Moderation, computers assist the moderator in accomplishing process flow, handing out material to the participants and calculating visual presentation of the group results.

For example, facilitation meetings can cope with social issues (e.g. “Cooperation between different divisions does not work out.

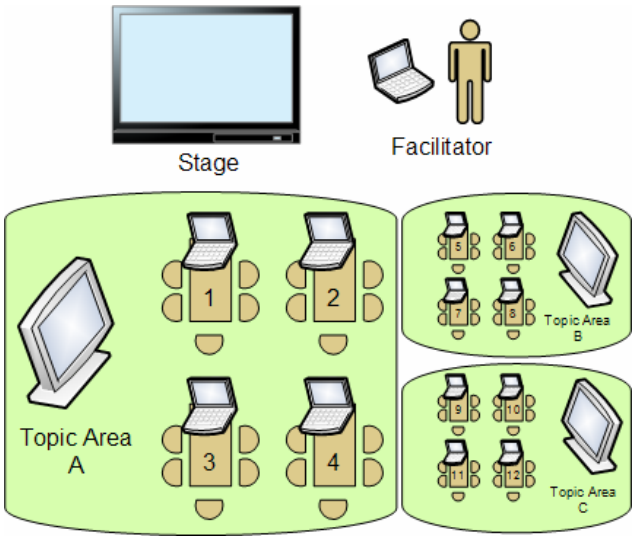

Figure 2. The venue contains several topic areas, which in turn group some tables. A group of participants seated on a table share the same laptop. There is a large public display on stage. The facilitator uses his laptop to control the software.

What are the reasons?"), selecting goals (e.g. "What should be our mission for the next five years?") or strategy finding (e.g. "How can we optimize our efficiency?")

The software Digital Moderation implements several kinds of well-known facilitation methods such as polling, brainstorming, ranking, clustering, collecting questions and giving recommendations based on previous discussions. These methods are used to structure the group process so that it results in a solution to which every participant contributed.

To foster discussions between participants and reduce the feeling of anonymity, small groups are seated at the same table and share one computer (see Figure 2). Often the facilitator asks each of them to enter their opinion, but sometimes they are invited to discuss first and enter only a single contribution as a team. The participants should exchange seats some times or visit other tables in order to convey their ideas to other groups.

If conductive, several tables can be grouped to a topic area in which issues are examined under a special perspective (see Figure 2). For example, all members of a division can be seated in one topic area, so their contributions can be easily distinguished. Alternatively, the topic areas stand for different imaginary roles or aspects and the participants are asked to walk around and enter relevant contributions.

Contributions can be submitted anonymously as well as named. In the latter case it is possible to give awareness by pointing a spotlight at the table, whose contribution is currently discussed. It depends on how sensible a topic is whether or not this should be considered.

It is important for successful moderation that neither facilitator nor chief executives dominate the result according to their own opinion. But introducing democratic polls in every situation can slow down the process as the number of participants increases. On the other hand, for the participants to remain attentive their passive phases should not be too long and the overall process must be rather tight and diverse. The facilitator has to balance these two contradictory goals and computer support can effectively contribute.

3.2 Extending Digital Interaction System

Digital Interaction System implements all options used in Digital

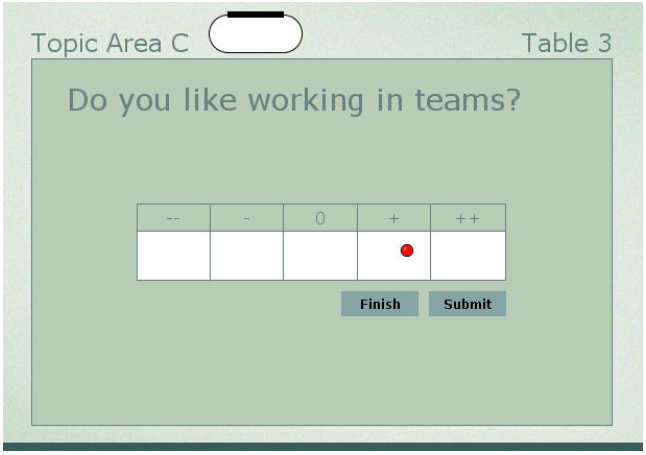

Figure 3. Entry mask of a poll which is filled out by the participants at table 3, which is located in topic area C.

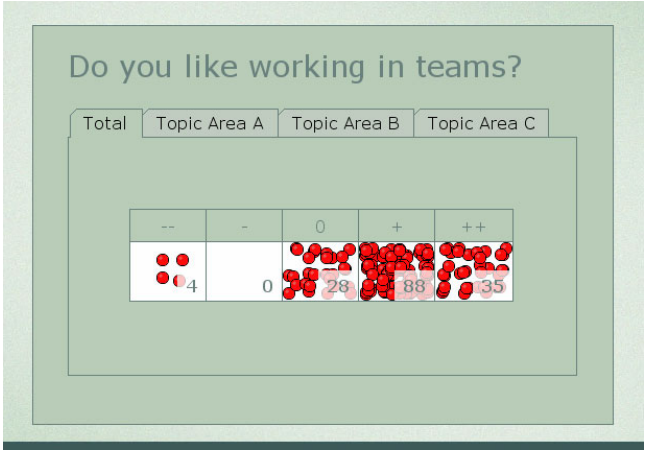

Figure 4. Presentation of the poll results of all participants is displayed on the video projector at stage.

Moderation such as the concept of tables and topic areas, group and personal contributions, and different kinds of facilitation methods.

Digital Interaction System is a distributed client/server system. Client computers can be used as different kinds of stations (similar to participant, facilitator, stage and topic area), and are located in one of the topic areas, with a unique table number.

Digital Interaction System is implemented in Java 1.4 and based on Agilo, a framework for synchronous groupware (where all members operate simultaneously) developed at Fraunhofer IPSI.

Each of the facilitation methods (poll, brainstorming, etc.) described above is implemented as a tool in Digital Interaction System. The general term "tool" is chosen on purpose, since the methods do not have to be derived from the context of facilitation. Any kind of process where participants and other involved people can enter data, which is visually aggregated and displayed on any of the stations, can be implemented as an extension.

Each tool implements several phases such as the explanation phase, where the usage is demonstrated to the participants, the action phase, where participants enter their contributions and the result phase, in which the results are presented to the audience. More phases can be added on demand.

It is possible to combine tools so that one refines the results of a previous process. For instance, the results of a brainstorming will be refined during ranking, and recommendations will be given to the highly ranked ideas.

Furthermore, phases of different tools can be mixed, for instance the results of a poll can be revealed after the group worked on some other tasks or results of a brainstorming can be augmented after each given talk.

To demonstrate how these concepts can be used in a different domain, we sketch the implementation of the game charade: In the initial phase, a performer is chosen and the solution word is entered into the system. In the next phase, the performer tries to convey the solution by acting. The laptops at the table show a text field where the guess can be entered. As soon as one table enters the right solution, the next phase is entered, where the winner is announced and statistical data can be presented on the public

displays. Since all participants are at the same venue, the actor is visible to everybody without computer mediation.

Digital Interaction System supports large groups of people that can be partitioned into fluently changing subgroups. Face-to-face interaction plays a major role, since the number of computers is much smaller than the number of participants and all people are co-located. The focus of attention can be controlled by the use of public and table displays.

4. APPLICATION TO GAMES AND VICE VERSA

This section examines the opportunities of Digital Interaction System in the area of massively multi-user games and how these games will contribute to outcome of tasks that will be solved using Digital Interaction System in a business context.

4.1 Opportunities for Co-located Massively Multi-User Games

Digital Interaction System enables a couple of new concepts for co-located massively multi-user games.

Since all participants share the same venue, it is not always necessary to support indirect communication via computers. In some cases, it might even be better to ban computer mediated communication in order to drive participants to leave their seats and start a conversation.

By limiting access to the resource "computer", participants are automatically kept from mentally focusing too much on the laptops. Moreover, large venues are expensive and space should therefore be used wisely.

The venue can act as a game board if the tables are positioned accordingly. Every table that is equipped with a laptop (usually used by the group of participants seated at the table) can form one field of the game board. Players can move along neighbored tables like playing pieces on a conventional table-top board, besides that in this case multiple players should be at the same field. Special rules could make participants move to another station or exchange seats with other players.

Some actions may affect only the participants currently sitting at a given table (or the near surrounding) like an exploding bomb which hits only a local area. Besides that, different kinds of actions may only be employed at some stations, e.g. players can produce goods at some table but have to sell it at other stations.

Figure 5. Participants discuss about how to achieve a common goal.

Stations can represent home bases for different teams, but they can also be used as special counters, where various teams can enter something, for instance they could place a bet for a horse-racing game.

Displays that are public to varying degrees can be utilized. Digital Interaction System currently allows to have displays public to all participants (located at stage), to some close-by tables (topic area displays), or a single table (participants´ clients). In the near future, the use of PDAs or other small devices will be supported, too.

4.2 Games in Business Applications

In the context of business cooperative work applications, it is desirable to have games. For example, if unacquainted people participate, games can be used as ice breakers, so people get to know each other. In meetings with several days duration, a recreational fun event is often requested (like for example at the leadership conference in October 2004). But the just cause is that games can be used to stimulate and intensify cooperative behavior between individuals and teams, which has a positive impact on the work result. These three usages will be of special interest if the meeting takes place rarely, like conventions, conferences or retreats.

The objectives of this work are concepts for games that stimulate cooperative behavior, and fit into the setting of Digital Interaction System. Since the intended purpose of these meetings is not gaming, the play should not take too long (e.g. less than one hour).

4.3 Stimulating Cooperative Behavior

When will a game stimulate cooperative behavior? If a player benefits from cooperating with others in reaching the game's goal, she is driven to cooperate. When cooperating, a player finds out about the characteristic traits of the others like "Whom can I trust?" "Who is clever in solving puzzles?" "Who is eager to fulfill a task?" "Who is a good diplomat?". But she also gets to know in what topics other players are interested. This knowledge is the basis for planning further cooperative activities. The emotional identification with the team increases the mutual interdependence of individual activities [14].

Johnson and Johnson name in [8] positive interdependence as "the heart of cooperation". They distinguish between outcome interdependence and means interdependence. Outcome interdependence among members of a group exists if either all reach the goal or no one does (goal interdependence) and if they all get the same reward (reward interdependence). Outcome interdependence is a necessary condition for cooperation or competition. Depending on how the goal can be accomplished and the reward can be received, different kinds of means interdependences exist, which will improve the group performance even further. For example role interdependence exists, if each member has a special responsibility that the group needs to achieve the goal. A similar concept is task interdependence, where the tasks of the members are linked with each other as it is the case with divide and conquer strategies. Resource interdependence means that each member has only one portion of what is needed to complete the common task.

Furthermore, [8] states that a team will benefit in developing social skills like trust, accurate and unambiguous communication, accepting and supporting each other and constructive conflict resolution. On the other hand, group dynamics such as social loafing, free riding, group immaturity, uncritical and quick acceptance of members´ dominant response and group-think should be avoided.

In addition, [8] enumerates promotive interaction (influencing each other's efforts to achieve the goals), self-determination of the groups´ strategy, and group responsibility as additional promotive factors for cooperation.

In a game scenario, participants do not have to be afraid of disadvantages like in "the real life", so it is more probable that they take the risk and experiment with cooperation, compared to business work-situations. We assume that once participants got into a team playing mood, it is very likely that they will continue to act as a team when the game is over – especially if they were successful as a team. Nevertheless, there is a small chance that the team cooperation does not work out and the team members will not be able to work closely with each other anymore. In this case, the work situation benefits from the knowledge that these people do not get along with each other.

5. EXAMPLE: TRADING GAME

This section describes an example game that emphasizes face-to-face negotiation, which is prototypically implemented in Digital Interaction System.

5.1 Idea

Participants located at the same table form a team. Each team gets some initial goods (e.g. two sheep, three shoes, ten matches). The goal is to solve a task (e.g. build a boat for the local fire department) for which the team needs some other goods (e.g. three trees, 100 nails).

Each team has to find out which goods are needed to solve the quest and buy them from other teams. To achieve this, the team has to find out which goods are available in the game, who has the needed goods and under which circumstances they are willing to exchange them. Also know-how can be used as payment, for instance a player could offer mediation between two other teams or help to find out what they need to solve their quest (e.g. if red paint is not available in the game he can suggest to use raspberries instead).

At the beginning of the game, teams are asked to think about a strategy first. For example they should assign themselves different tasks, such as initiate contacts to other teams, find out what goods are needed to solve the quest, try to buy a needed good. Optionally, we are going to experiment with the following option: In each team, one member will be a spy for a different team. The team then has to find out who to trust in order to survive.

The computer supports the game by managing the goods and goods exchanges and determining if a team has solved its quest and which team solved it first.

We want to drive participants to communicate face-to-face on the one hand, while on the other hand we do not want to slow the game down by low-level coordination that does not contribute to the group effects. To balance this we allow players to send

Figure 6. An agent (right) offers trees and raspberries. The bargain is stroked at the price of one sheep and 100 matches.

messages to one of the public displays. The team is asked to agree on secret code words. This element might also introduce another strategic role: the code breaker, which tries to find out what other teams talk about.

5.2 Implementation

Each table serves as a home base for one team. At the station, the team can view the list of the goods it possesses. When trading goods, the two salesmen have to meet at one of their two stations. They have to authenticate and enter their offer. When they agree on the bargain they execute the "Exchange Goods"-button (see Figure 6). The exchange will only take place, if both teams still possess the goods they offered, since other team members could have sold the goods in the mean time.

To avoid such situations, the members can send anonymous messages to a public display from any station. This facility can also be used to announce trade offerings to all players, since it is up to the sender to encrypt the message or not (see Figure 7, background). Care should be taken that computer-mediated communication will not totally replace direct communications.

In the solution-view (see Figure 7, foreground) the task is displayed. In this view the participants can also try to solve the quest. Only if they have all the necessary goods, the try will be successful. Both, the number of unsuccessful tries and the time needed to solve the quest influence the ranking of the teams.

The input masks are designed so that the participants can show their possessions to other team members without revealing their quest, and they can trade wile revealing neither possessions nor goal.

The trading game was recently implemented in Digital Interaction System.

5.3 Discussion

According to the effects described in 4.3 "Stimulating Cooperative Behavior" this game stimulates positive interdependence and group's self-determination.

For the members of a team, achieving the goal and getting a reward is coupled. Either they win together and get rewarded or

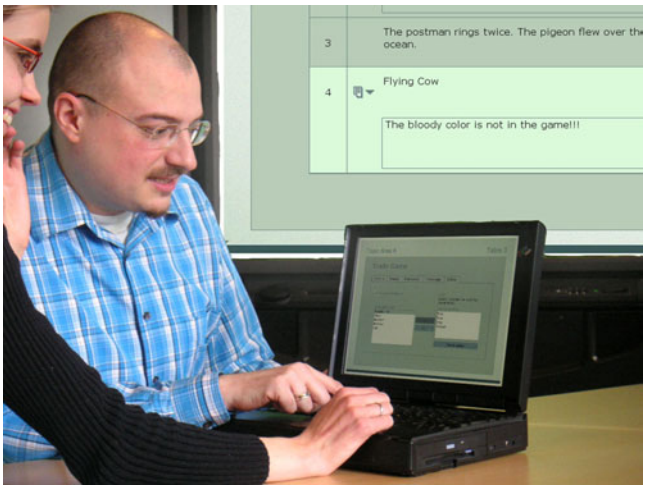

Figure 7. Via the public display, the team gets the hint that red paint is not available in the game. They discuss whether raspberries are an appropriate alternative.

they loose. In addition to that, cooperation between different teams is necessary, so goal achievement benefits from inter-team cooperation. Since the team is asked to agree on their strategy first, task and role interdependence are probable to exist. Moreover, the strategy and the secret code will contribute to the emotional team identification. Mutual resource interdependence does also exist, since members are going to spread throughout the venue in order to find trade partners and their contacts are a resource the whole team depends on.

Although this game does not train the social skills like unambiguous communication or constructive conflict resolution explicitly, they are an advantage in this game and will be rewarded.

While the spy may hinder a trusting atmosphere, which does not add to cooperative behavior [8], we think that it is an interesting game element and an opportunity to train who to have confidence in.

Because personal interaction plays a major role in the game, people will find out about characteristic traits of the players they interact with.

Does the trading game work out in large groups? Although the evaluation is still to come, we regard this game rather boring in small groups, because of its simplicity. For example, if it is played with 10 teams, where each team has five members (50 participants), it is manageable for only one member of a team to communicate with all other teams. We think that the game improves the cooperation best, when the team is forced to divide the work, because no one can handle everything by himself.

5.4 Pervasive Interface Issues

Until now, we concentrated on the general game concept thus the user interface is not very usable or convenient.

Drawbacks result from the following probortunities [4]:

- How do we take care that goods are not stolen?
- How do we make sure that players can not catch sight of team's secrets without the agreement of the team?
- How can traveling salesmen retrieve the current status of goods?
- How can we focus the team's attention on the group process instead of low-level coordination tasks?

The current implementation relies on password authentication when trading goods. One member of the team has to stay at the home base to make sure foreign players do not find out secret information. Participants that want to trade with distant teams have to take notes, and when the available / needed goods change, they have to be informed by their team members.

The next version should employ pervasive technology to overcome obstacles that hinder the group process.

For instance, fingerprint recognizers or RFID-Tags could be used to authenticate for a trade. Proximity sensors at the home base could lock the computer, if no team member is near the table. They could also hide private information if a foreign player enters the line of sight.

Some players could be equipped with PDAs to check the depot of currently available goods if they are not at their home base. PDAs can also be used to display secret information. An alternative approach is the use of colored glasses (e.g. with red-filter, green-filter, etc) that reveal secret information on a public display.

6. EXAMPLE: VIRTUAL BALL GAME

This section gives another example of a game that stimulates cooperation. We sketch a virtual ball game that calls for participants' imagination and that lets laptops go into the background.

6.1 Idea

Each participant's head forms a three-dimensional point on a virtual surface that goes through the whole venue. The other points of that surface get interpolated. For that reason, the forehead of every participant is equipped with a three-dimensional sensor (e.g. fastrack [15]). As the players move around, bow down or jump up, they change the virtual surface accordingly, like a blanket that is placed over all participants (see Figure 8).

There are several virtual balls rolling over the virtual surface, like over an alpine scenery. The direction depends on the impulse of the ball and local gradient of the surface. The direction of the ball can be influenced by moving around, since this reshapes the surface. Each ball in the virtual world is represented by a spotlight, which points to the location of the ball in the physical world. This representation can be augmented by acoustic effects. In addition, several displays (participants' laptops as well as public displays) show the virtual surface and balls as a 3D-animation.

Participants that share the same table form one team. In the virtual world their laptop is a basket, where the balls fall into and are collected by the team. The teams' goal is to collect either red, green, or blue balls, and none of the other colors. Teams with different goals are distributed equally throughout the venue, so neighbored tables of a team can have the same or a different goal. Members of one team can go to the surrounding of a different teams´ table and shape the surface at that region, as part of the interaction.

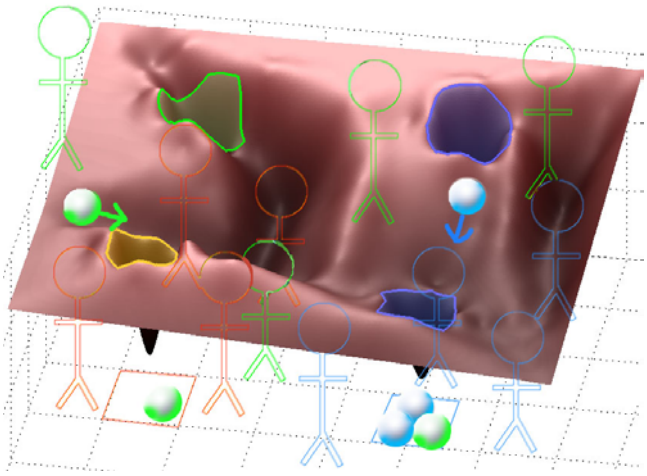

Figure 8. Several colored balls roll over the surface, which is a Spline-interpolation over the participants´ heads. The blue ball (right side) is moving towards the blue team's basket, which has currently a score of 1 (two correct and one wrong ball). The green and the red team are cooperating. Two members form a valley in which the green ball (left side) is rolling into. As soon as the ball enters the valley, these two members will stand up to push the green ball into the green basket.

6.2 Cooperative Strategies

A team can use different strategies. They could play without interaction with others, i.e. wait for a ball to approach, if it has the right color push it into the basket, if not, push it away. The alternative would be to cooperate with other teams, like waiting for a ball to approach and push it to the basket of the team that collects this color. If one would like to tease another team, he could push a ball of the wrong color into the other team's basket. Another way of teasing is to hunt for a ball wanted by another team.

The different kinds of cooperative, egoistic and competitive strategies can be combined. For example, a team can start with a fully cooperative strategy until it gets picked on by another team, which can be retaliated by switching to a competitive strategy. When they figure out that neighbored teams can not be trusted, they can try the egoistic strategy.

Although playing competitively can be more fun, the destructive behavior will lead to an advantage of uninvolved teams, while the two hassling teams will keep each other from reaching their goal. Since egoistic play may be considered rude, the team has to rely on balls approaching by accident. Cooperating teams will get a higher number of correct balls, since they profit from each other.

6.3 Discussion

This game concept contributes to cooperation as described in 4.3 "Stimulating Cooperative Behavior".

As with the trading game, the members of the same team win or lose jointly. The team can embark on different strategies, but cooperative play will probably lead to the highest score. This way cooperating teams will both get rewarded. If a team gets betrayed, it has the possibility to fine the betraying team. This "balance of powers" leads to an atmosphere of trust, which is according to [8] one of the social skills that is very important for emerging cooperative behavior.

Since agreement on different roles such as defender, seeker, and coordinator will be an advantage, mutual role dependence is given. Furthermore, since each participant influences exactly one sampling point of the surface, forming the surface appropriately needs tight cooperation and coordination within the team. Unwanted group dynamics like free riding and social loafing lead to a very low score. This effect can be regarded as task interdependence (if not all members fulfill their tasks, the goal will not be reached) and promotive interaction (members influence each other's efforts).

In contrast to the trading game, the virtual ball game focuses more on the cooperation between different teams. On the other hand, interaction will mainly occur between players in the neighborhood. Although the neighborhood will consist of approx. thirty players, in longer plays rules should be introduced that make the teams change their neighbors from time to time.

7. CONCLUSIONS

Lundgren et al. [9] and Magerkurth et al. [10] state the significance of social interactivity and collocation in gaming experience. Cheok et al. says in [2]: "one of the top reasons why people like to play games is that it is usually a social activity people can enjoy with others".

The objectives of this work are concepts for games that stimulate cooperative behavior among participants of a co-located, very large group, and fit into the setting of Digital Interaction System.

The active principle of the presented trading game is to make participants talk to each other and to find out how people behave in different roles and situations (being a spy, being spied on, betraying, being betrayed, helping each other, convincing others to sell). The trading game was recently implemented in Digital Interaction System. A first evaluation will take place within the next weeks.

The approach of the virtual ball game is informal cooperation in combination with a new kind of interaction and imagination without a strong emphasis on talking.

According to [8] both games increase positive interdependence among players of the same team as well as among players of different teams. They also embody the concept, that cooperation will help reaching the goal. Besides that, they emphasize the team spirit and increase the activity of participants and the duration of the play will not take too long.

Our hypothesis is that these kinds of games will stimulate the cooperative behavior of the participants in general and thus will lead to better results of team work. This hypothesis is still to be proved. In addition to that, we are interested in exploring other game concepts that stimulate large-scale cooperative behavior. The social effects of these games, as well as of the two given examples, have to be examined and game mechanics that improve the wanted effects should be isolated.

In the two presented massively multiplayer co-located games, the computers (although they are not hidden) go into the background, and the most part of the attention is paid to social interaction. The next step is to improve the prototypes and concepts of the

example games with intuitive interfaces, so the participants get less distracted from their game goal and the group effects we want to stimulate are supported.

We are still interested in more game concepts that contribute to cooperative behavior. With well founded experiences, those games could be offered to business companies to train their executive employees on team work or to evaluate appropriate aspirants for leading positions.

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9. REFERENCES

[1] Björk, S. et al. Pirates! Using the Physical World as a Game Board. In *Proceedings of conference on Human-Computer Interaction (Interact 01)*, IOS Press, Amsterdam, 2001, 9-13.

[2] Cheok, A., Fong, S., Goh, K., Yang, X., Liu, W., Farbiz, F., Li, Y. Human Pacman: A Mobile Entertainment System with Ubiquitous Computing and Tangible Interaction over a Wide Outdoor Area. In *Proceedings of mobile HCI 2003*, Springer Verlag LNCS 2795, Udine, September 2003, 209-223.

[3] Danesh, A., Inkpen, K.M., Lau, F., Shu, K. and Booth, K.S. Geney: Designing a collaborative activity for the Palm handheld computer. *CHI Letters: Human Factors in Computing Systems, CHI 2001*, 2001.

[4] *Definitions of creative thinking, lateral thinking, brainstorming, probortunity.* Online: http://www.brainstorming.co.uk/tutorials/definitions.html (Retrieved: Feb 8, 2005).

[5] *EverQuest II.* Online: http://everquest2.station.sony.com (Retrieved 16.02.2005).

[6] Flintham, M. et al. Where On-Line Meets the Streets: Experiences with Mobile Mixed Reality Games. In *Proceedings of the ACM CHI 2003*, 569-576.

[7] Holliday, S. *Storms on Cloud Nine #16: Cooking a MMOG.* Online: http://www.skotos.net/articles/storms16.shtml (Retrieved: Feb 8, 2005).

[8] Johnson, D. W. and Johnson, R. T. Cooperation and The Use of Technology. In: *Handbook of Research on Educational Communications and Technology.* 2nd Edition, Edited by Jonassen, D.H., Lawrence Erlbaum Associates, NJ, USA, 2004, 785-881.

[9] Lundgren, S. and Björk, S. Game Mechanics: Describing Computer-Augmented Games in Terms of Interaction. In *Proceeding of Technologies for Interactive Digital Storytelling and Entertainment (TIDSE).* (Darmstadt, Germany, June 24-26, 2003).

[10] Magerkurth, C., Engelke, T., Memisoglu, M. Augmenting the virtual domain with physical and social elements: towards a paradigm shift in computer entertainment technology. *Computers in Entertainment (CIE), Volume 2, Issue 4* (Oct. 2004). ACM Press, New York, NY, 2004.

[11] Mandryk, R. and Inkpen, K. 2002. False prophets: Exploring hybrid board/video games. In *Extended Proceedings of CHI 2002*. ACM Press, 640-641.

[12] Metaplan GmbH. *Primer for the Metaplan Technique.* Online: http://213.39.247.76/download/english_g.pdf or http://www.metaplan.de/download/login.htm (Retrieved 16.02.2005)

[13] *monochrom's massive Multiplayer Thumb-Wrestling*. Online: http://www.monochrom.at/daumen/netzwerk-eng.htm (Retrieved 8 Feb, 2005).

[14] Mühlfelder, M. *Das kollektive Handlungsfeld: Ein psychologisches Konzept zur Modellierung interpersonal koordinierten Handelns*. PhD Thesis, University of Flensburg, Germany, 2003.

[15] *Polhemus Fastrak – The Fast and Easy Digital Tracker.* Online: http://www.polhemus.com/fastrak.htm (Retrieved: 16.02.2005).

[16] Schneider, J. and Kortuem, G. (2001). How to Host a Pervasive Game - Supporting Face-to-Face Interactions in Live-Action Roleplaying. *Position paper at the Designing Ubiquitous Computing Games Workshop at UbiComp 2001*, Atlanta, GA, USA, September 30, 2001.

[17] *Thilo Wagners LARP-Kalender: Sankari 5 - Wolfskopf* Online: http://www.larpkalender.de/termine/2333 (Retrieved: 16.02.2005).

[18] Vogiazou, Y. and Eisenstadt, M. Presence Based Play: Towards a Design for Large Group Social Interaction. In *Proceedings of the First International Conference on Appliance Design (1AD)* (Bristol, UK, May 6-8, 2003).