Mullivelled – Wrapping Computer Games into Educational Gaming Environments

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Abstract

Cooperation and collaboration need a lot of positive experience and training for their development. Software production is nowadays a work where team collaboration is needed, but university teachers claim, that computer science students prefer to communicate with computers, not with other human beings. This article describes the attempt to use a computer game to facilitate computer science students to develop a better attitude to collaboration. For this we propose a game frame with three phases: playing alone, playing with random team members, and playing with a real collaborating team. Any existing computer game, which satisfies our prerequisites can be used in this frame. We describe an example in which we redesigned the game Bub's Brothers. We present and discuss test runs and describe our future plans.

Introduction and problem

All teachers know, that the key issue in learning is motivation - as M. Prensky formulates it: “a motivated learner can't be stopped” (Prensky, 2003). Cooperation and collaboration need a lot of positive experience and training for their development. They are needed nowadays in most workplaces to succeed as a team or a company. This is especially true in software production, which is an ever growing field of human activity. There are plenty of anecdotes about IT people's inability to communicate with human beings - they are claimed to communicate with computers only. This inability will lower the quality of IT work significantly. In an academic context where IT specialists are taught, there has to be taught both: programming skills as well as teamwork and communication skills.

The following anecdote shows, that this is not always an easy task:

In a software technology course at the University of Tartu, where the students learn how software systems are designed and programmed according to a user's needs, the course teacher asked the students to work in small teams of three to four people for a task. The task was to write a description, how the particular future user will interact with a planned software system. Those descriptions have to be written in a everyday language (not in special computer language) and are the base for the future software systems. As it is an unusual experience for students, who will become system designers, to put themselves into the shoes of the other party, a future user,the teacher hopes that discussion in small groups will give them insight into the user's perspective. As a result, every student tried to write a description alone and many failed. At the same time three students were sent to the blackboard, where under the supervision of the teacher they communicated and solved the task very successfully. Others had no idea how to copy the procedure.

This is one example which shows that students studying computer science in Estonia, are often not very talkative and try to avoid team tasks, or try to solve tasks, which need mutual collaboration, simply by dividing tasks into disjoint parts and appointing to every team member a stand alone part to do. There are many reasons, why teamwork is sometimes avoided - we will discuss some of them later in this article.

Improvement of teamwork seems to be a shared concern of various institutions. Companies and research groups, public and private sector – everybody is stressing the high importance of teams as sources of innovation and efficiency (Stott&Walker, 1995). Though there is a lack of consensus concerning the core components of teamwork, the following characteristics are mentioned most often: team leadership and mutual performance monitoring (Salas et al, 2005), (Levi, 2001), trust and group cohesion, cooperative goals and open-minded controversy (Tjosvold et al, 2002). Most authors agree that these are all necessary but not sufficient conditions for effective work in different kind of teams.

The possible reasons why people are not eager to work in teams could be divided into two groups. First, the general ones, for example the cultural background (representatives of some nations seem to be more individualistic than others); previous educational experience (where collaboration is often interpreted as cheating and is penalized by teachers); nature of the computer science (activity where one is expected to "collaborate" with computers, not people).

Second, personal attitudes should be taken into account, which are illustrated by statements like:

- I am more clever than others, why do I have to discuss my solution with others!
- I do not want others to see how stupid I am.
- I do not like my team members, why do I have to communicate with them?
- What I have is mine, I have developed this solution and it is mine!
- I am the leader, I do not want others to have chance to impact the decisions.

As some of the authors are working in this environment, we started to develop a game to facilitate collaboration. The advancements in collaborative computer games, which started with Multi User Dungeon (MUD) and MUD Object Oriented (MOO), have developed into graphical computer based role playing games (RPGs) and massively multiplayer on-line games (MMOGs). As this is one of the media, computer science students are exposed to today, this has given us the idea to use computer games to experience successful teamwork. We try to achieve this via supporting to overcome prejudices and psychological barriers of computer science students against collaborative work.

This article describes our first attempts to develop a prototype of a frame game facilitating this experience. We combine the fun of the game with the realization that cooperation without communication is better than trying to solve tasks alone. Furthermore we built into the game the realization that real collaboration, with communication and collaborative strategy planning is the best way to solve problems.

We want to achieve with the game:

- to give the students' positive experience of effective collaboration,
- to encourage communication in between them,
- to support to overcome prejudices and psychological barriers,

- to prove that collaborative strategy planning is more efficient than teamwork without communication,
- and to experience that the latter is better than working alone.

The design paradigm for a frame game

The game will be introduced with a winning condition fixed on the solution of a number of tasks. The more tasks are solved the better. If there is a tie, there must be a distinguishing criteria like points. This criteria must be applicable to individuals and groups of players. This is easy in the case of points, where just the sum can be regarded.

The frame of the game consists of three phases:

1. Playing alone and learning to handle the game. Everybody plays at their own computer monitor.
2. Playing together with random team members. As the team members are not known, communication is not possible. Everybody plays at their own computer monitor.
3. Playing as a collaborative team. The team is given time and a handout of the tasks to solve to plan strategies. Communication between the team members is allowed and encouraged. The game will be carried out in front of one big screen.

During all the three phases the embedded game is the same. Therefore we need a game, which has the following characteristics:

1. It is a computer game.
2. It can be played with multiple players over the network (either Internet or a local area network - LAN) .
3. It can be played individually...
4. .... (but) cooperation is a prerequisite of success.
5. It should not need a long time to get accustomed to it (quick learning by doing)
6. The game must be slightly modifiable and configurable, so that it can be integrated into the frame game.
7. It should be easy to design a number of ordered tasks.

One of the games fulfilling these characteristics is the open source game Bub's Brothers (“Bub's Brothers”), which is a successor of the old arcade game Bubble Bobble[1].

Application of the design to the game Mullivelled

MulliVelled is an Estonian word consisting of mulli and velled. Mulli is the bubble and velli means brother and friend. This is, why it can be translated as “Bubble Comrades” or even more freely as “Bubble Connection”.

The website of Bub's Brothers quotes “Features: 1 to 10 players – the best fun is with at least 3 players”. This just meets our prerequisites. We can play it with only one player, but playing it with three or more creates positive emotions. As we want to re-

1 Somebody of the older generation might remember.

fer to the situation in the classroom, we are interested in the possibility to play the game with three to five persons, which is possible here. To meet the actual class room size (in Tartu, this would be something from 10-40 students), we can play multiple instances of the game at the same time, carried out by groups of the size three to five.

In the game, every player steers an avatar represented by a small dragon of a different color. The game consists of various levels (or playgrounds), which have to be solved to advance to the next. The avatar can move around (left, right, jump, and fall) and fire big bubbles. There are moving enemies, which send if touched, the avatar back to the starting position. To solve a level all enemies have to be caught in bubbles and the bubbles have to be exploded via touching them. Sometimes it is difficult to capture the bubbles, because there are winds blowing them away. If a bubble is not exploded soon after capturing an enemy in it, the enemy will come out of the bubble again and even be faster and therefore more dangerous. These angry enemies will be shown read. Bubbles can also be used to jump on top of them to reach a higher platform. Furthermore bubbles can be used to catch other avatars (of other players in the same game), which enables them to move freely over the whole level area and escape the bubble at a selected point.

The levels are the tasks defined in the previous section which are supposed to be solved. When one level is successfully finished, automatically the next appears. This means the goal for the players is to reach the highest level possible. When exploding the bubbles with the caught enemy, they turn into bonuses, which give points, when collected. These can be used in case of a tie at the end.

We designed Mullivelled as a computer game for students (typically, but not restricted to, the age 18 to 25). In the prototype we provide the following six levels of action and problem solving. The levels become step by step more difficult, in higher levels cooperation is useful and the last levels are impossible to solve alone. In every phase the same set of levels will be played and every phase will start again with the first level.

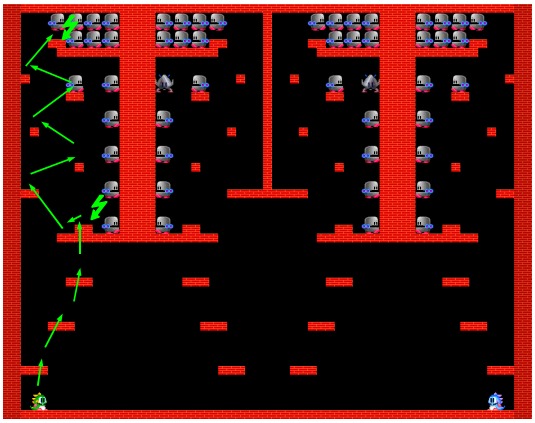

Figure 1: Level 1, learn to jump and to catch and explode enemies.

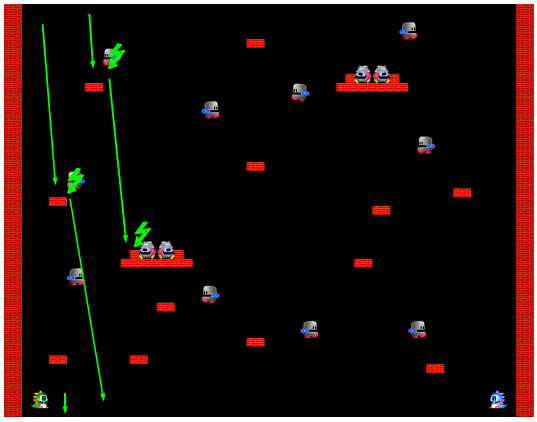

Figure 2: Level 2, learn to fall and fly.

Figure 1 shows the first level. The green arrows show a possible way of a dragon to solve a part of this level. The green lightning bolts are the positions where caught enemies can be exploded. The level is designed to get used to the navigation and especially learn to jump in different directions. As the enemies are locked on their platforms, you can easily practice how to catch them in a bubble and explode the bubble later. If you play with multiple players, this level will be finished faster. It is

solvable most efficiently with four players. In this case every player takes care of one of the four columns. This level has apart from a parallel approach no direct need for cooperation.

In Figure 2 level two is shown. It is meant to practice navigation while falling (flying). Also timing to catch enemies can be practiced. Like the first level with multiple players it will be solved faster, but has no direct focus on cooperation.

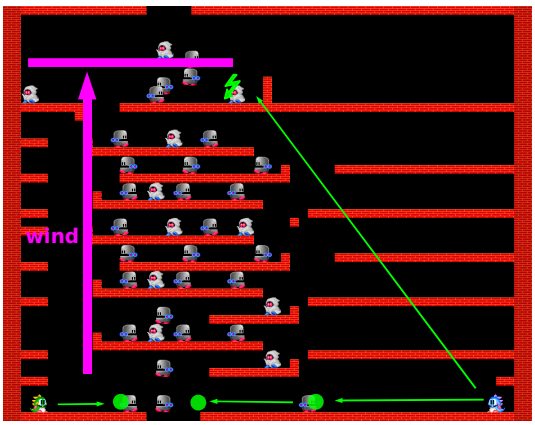

Figure 3: Level 3, works much better with some coordination.

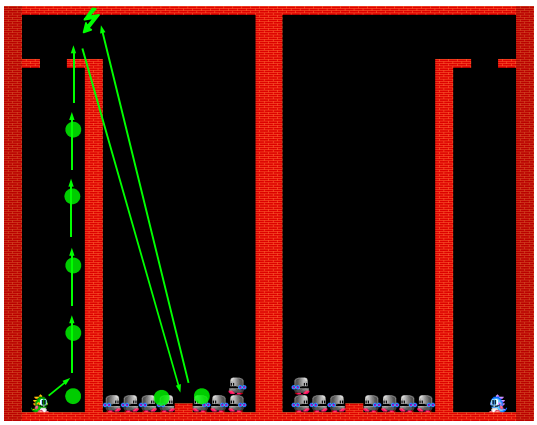

Figure 4: Level 4, unsolvable as individual.

Figure 3 depicts level three. Here are tons of enemies, which very easily become red (this means: fast and dangerous). Coordinated multiple players greatly speed up the solution of this level. In the first phase you can apply here your practiced skills. In coordinated mode some should bubble here on the lower level and some should go up, explode, and touch an enemy afterwards to return again to the lower platform. It makes sense to first wait on the lowest platform until a number of enemies are captured in bubbles and then send some dragons up to explode them. If there is not enough patience all enemies get red and dangerous. The wind will carry enemies captured in bubbles to the top of the screen.

Level four (see Figure 4) can only be solved with at least two players as the dragons can not pass through the center column. Four players are even better. In this level, you have to learn how to jump on bubbles and get over the column. Also aim exactly on the small platform when you jump down. As the captured enemies will sink through the floor and come out again at the top, another player is handy, which sits on the column and can explode the captured enemies.

Also level 5 (Figure 5) needs cooperation to be finished. Here you have to jump on the bubbles provided by your companion for you and reach the upper part of the screen to clear the left or right side. If you have four players, both sides can be cleared in parallel.

In the last level, number six (Figure 6), you first have to go through the hole in the bottom to the upper part of the screen. Over there one of your companion has to capture you in a bubble. This only works coordinated and from the right distance. After being captured you can move to the walled part in the center and explode out of the bubble to catch all the enemies of one side in a bubble. As the wind blows the bubbles in the upper part, your companion has to explode the bubbles there.

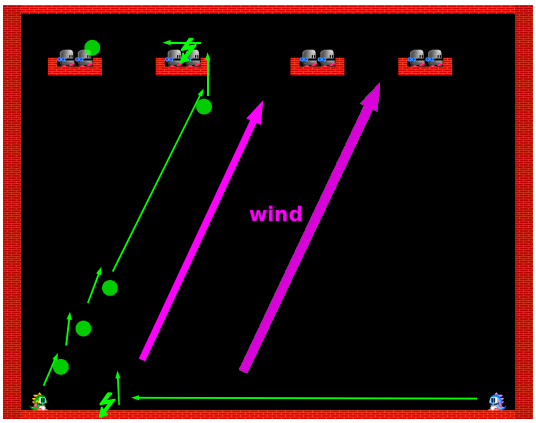

Figure 5: Level 5, support your companions with bubbles.

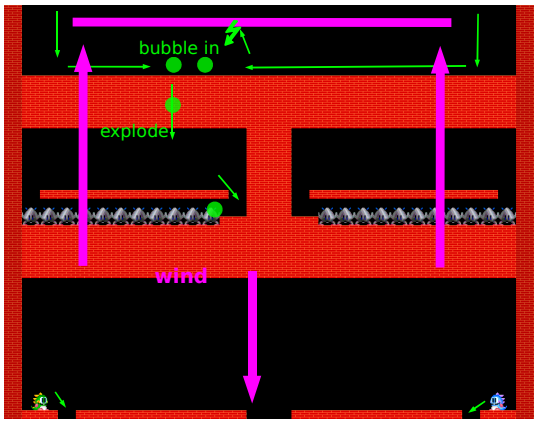

Figure 6: Level 6, let yourself be captured in a bubble.

The first rounds are played individually to test the ability and arise competence in playing. The next levels are played in groups. In the second phase, the first round played in groups, the group members do not know each other and play without any communication. In the third phase, the players get the opportunity to discuss a strategy, like the ones described earlier, for playing in advance, before starting to play. For this strategy discussion, the six level pictures will be provided to the players to create their strategies.

The playing part of every phase will receive seven to ten minutes time to finish. For the third phase, three to five extra minutes will be provided to discuss the strategies.

We expect, that in the first phase the players will mainly reach the second level, probably some will reach the third. In the second round most groups will advance to level four, but it is unlikely that some will advance without coordination to level five. In the third phase, presumably most groups will reach level five and six. Some will be able to solve level six. The levels are designed so that the last levels can only be solved in coordinated cooperation.

After the third phase the game should be debriefed. We are still gathering input from test sessions and calibrating the game accordingly. Therefore we just present some suggestions and possible observations here.

One of the first questions to ask will be what the students have observed themselves while playing. They will mention fun playing and even more fun playing together. They will mention, that there are different roles, like making bubbles or jumping on them. Also they will discover, that there are different people with different abilities, which all turn out to be useful in finishing specific levels. Some students will be disappointed, because they could not make use of their abilities, or they could not do anything as others were faster.

In the last phase some groups will start to talk and shout to each other in the game and engage in a very passionate form of communication in the game, when they want to coordinate their strategies. It is also interesting to observe here people from the audience who usually also try to interact at this point.

These aspects should be covered by the facilitator and mapped to the goal seeking necessary in teamwork in the class room. For example the jumping dragons can be mapped to people with the abilities to turn algorithms into life and the bubbles to

people delivering resources. Also the strategy planning will reveal a lot of team facilitating observations.

The debriefing should mainly focus on the transition between the second and the third phase as the first phase is merely important to get used to the control of the game.

First results

Will this be another game in a style what Kurt Squire calls "chocolate covered broccoli"? (Squire) We will leave the answer to the readers and players.

We have run this game for a demonstration purpose in February 2008, with the game design course, led by Prof. Jan Klabbers (“Tartu Ülikooli Viljandi Kultuuriakadeemia - Aktiivõppemängude juhendajate koolitus”). We played it with four test persons and an audience of approximately ten persons. This enabled only one group in phase two and three. We discovered, that technical problems related to network restrictions can make it very difficult to set up the game environment (even with only for participants). Bub's Brothers depends on a stable network and only allows fluent playing, if all the players are in the same physical network segment. This leads to some hardware requirements for setting up multiple instances of this game. Bub's Brother lets the players select the color of their avatar and define their keys to do there moves (left, right, jump, and fire) in the beginning. This selection is error prone and time consuming. In spite of the mentioned technical difficulties, we could get a glance at the power embedded in our game idea. The players and the audience confirmed, that the message of experiencing collaboration is very strong.

The second run was done with 15 computer science students. We split these in the second and third phase in groups of three to four students. The course was carried out in a Suse Linux computer class. We experienced serious technical difficulties in terms of timing the start and the end of the actual playing part. Some players started much earlier and played much longer, while some players could not log in to their account. This leads us to the conclusion, that we can not rely on the setup of the computers taking part in the game. Nevertheless, all students enjoyed playing and some groups with lower technical difficulties experienced the collaborative aspects we intended.

We are turning this synchronization and administration problems in its own area of research of “Orchestration of educational computer game environments”.

Summary and future plans

In this paper we presented a frame game to incorporate computer games, which can be played as well competitive as cooperative, in an educational game setting to experience benefits of collaboration. For this, the game is embedded in a three phases game, allowing to focus on collaborative aspects in debriefing the transition from the second to the third phase.

As an example, we wrap here the game Bub's Brothers in such a frame and present some results encouraging us to believe, that the message which this game transports is very strong, especially applied in a class room of computer science students. Bub's Brother was slightly modified for this purpose and equipped with six newly designed levels.

The testing rounds furthermore show, that using such kind of games in a class room setting has very technical demands. Flaws in timing and the used facilities can have a very negative impact on the message of the game. To enable such kind of games, we

no focus our research on a software framework to simplify and manage these settings for various computer games. We hope to open up with this a new research field for educational computer game orchestration.

The presented research is a result from the author group formed within the training course provided by prof. Jan Klabbers at the Tartu University Viljandi Cultural Academy between October 2007 and April 2008. To track further development of this game and of related research projects please visit (Norbisrath, Ulrich)

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