Support of social skill development in children age 7-10 through technology-aided games

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Abstract

In the first years of schooling, children define their social behaviours through a comparison of similar experiences to create behavioural patterns. Therefore, it is important to present children with positive examples of social interactions and to increase their awareness of different roles and viewpoints present in their social setting. Technological solutions could offer a valuable means to enable that learning process. Games that combine benefits of modern pervasive technology with the advantages of traditional play present a great opportunity for social skill development. In this paper we present Head Up Games (HUGs): Camelot and HeartBeat, which are examples of such pervasive games and discuss ways in which they support social interactions between children.

Keywords

Children, social interaction, games

Introduction

Around the age of 7 years old, children begin refining their social skills as a consequence of becoming a conscious member of a social group, namely their class. At this point in their lives, they start to spend more time with their peers, at school but also in their free time, and less with their parents [1]. While forming

peer groups, play becomes an important catalyst serving as a "common ground" [2] allowing children to initiate contacts between each other and socialize.

Games are played within what Salen and Zimmerman called a 'magic circle' [3]. Within the magic circle it is clear to all players that different rules apply than those in the real world. Thus, within the magic circle, children are free to act differently than what is usually socially acceptable, and as such are able to take on social roles that they would not do otherwise. This provides an opportunity for children to practice and develop social skills by situating authentic situations in a game context [4, 5]. Especially structured, rule-based games offer a means for learning skills such as collaboration and competition since they require from children to execute cognitive processes similar to these involved in the learning process (i.e., applying meaning, self-regulation, incidental learning, self-conceptualization and motivation [6]).

Not all games support such a learning process and not all games are suited therefore. We would like to point at an emerging genre of games, which opens up both implicit and explicit means for teaching social skills in children. We believe that a combination of ubiquitous, mobile and internet-based technologies offers opportunities for teaching social behaviours that moves 'beyond the desktop' experience offered by computer and Internet-based games [7]. Different forms of digital augmentation and different processes by which such information can be presented are likely to encourage exploring different behavioural patterns and also reflecting on child's own interactions [8]. In this article we present one specific genre of such ubiquitous, pervasive games called Head Up Games (HUGs) and

discuss its potential to leverage social skills in children of age 7—10 years old.

Play, games and social interaction

It is commonly acknowledged that play is an important aspect of child's development (e.g. [9]). Many skills can be practiced by playing games: e.g. physical skills, cognitive skills and also social skills. From a social perspective three types of play are distinguished [10]:

- **Solitary play**: the child plays independently and alone. If the child uses toys, they are different from those used by other children. If the child plays without toys no other children nearby are engaged in a similar play. There is no interaction with other children, a child makes no effort to keep close or to speak to other children, his or her interest is centered on his own behaviour, which is pursued without a reference of what others do. This type of play is common for very young children and pertains until late childhood.

- **Parallel play**: the child plays independently but the behaviour he or she chooses fits with the behaviour displayed among other children. The toys used to play are alike those used by nearby children but the child plays with the toys as he or she sees fit. If the play does not involve toys, the child's behaviour is of a similar nature to this of the nearby children. In any case the child plays beside rather than with other children; he or she does not attempt to influence the behaviour of other children and there is little or no interaction between them.

Usually, this type of play is first seen in young children age 4 to 6.

- **Group play**: the child plays with other children, interacting with them in the nature of the displayed behaviour. Interactions here include conversations, sharing toys, following or chasing one another, physical contact and organized play involving different roles. This type of play emerges around the age of 7.

Especially the last type of play (group play) offers the possibilities for children to assess how their social behaviours are perceived and evaluated by other children through exercising different styles of interactions with their peers.

Many traditional games (from the pre-technology era): such as tag, hide-and-seek or different kinds of ball games can be characterized as typical *group plays*. These games can be characterized as physically active and played with a limited number of basic objects that could be easily taken along (like a ball, a hoop, or a skipping cord). The rules of such games are often few and simple and can be easily adapted by players. In such games the play itself can be seen as providing a reason for social interactions between children rather than a goal in itself. We argue that these played-out social interactions are, therefore, the basis for social skill development. Paraphrasing [11] we further argue that social skills can and need to be taught, learnt and performed and that *group play* is likely to be the most effective way to do so for children age 7—10 years old.

Within any game, two levels of social interaction can be distinguished [3]: internally and externally derived

interactions. Internally derived social interactions emerge from the game rules. Externally derived social interactions emerge through pre-existing social roles brought into the game, e.g. friendships or rivalries. In any game players take on a social role, which can be shifted as the game progresses. For example: in a tagging game, one player can be "it", but once he or she tags another player, that other player becomes "it" and so on. Brian Sutton-Smith [12] abstracted the several types of social play roles, see Table 1.

Table 1: Social roles in games proposed by Sutton-Smith [12].

Role of an actor	Motive of a play	Role of a counteractor
To overtake	Race	Stay ahead
To catch, tackle, tag	Chase	To outdistance, dodge, elude
To overcome a barrier	Attack	To defend
To take person, or symbol	Capture	To avoid being taken
To tease, taunt, lure	Harassment	To see through, to move suddenly
To find by chance or clue	Search	To hide, cover
To spring prisoner, to be	Rescue	To be jailer, to guard against escape
To tempt a forbidden action	Seduction	To resist, have self-control

Now, how do social roles lead to social interaction? Both rules and the aforementioned roles give rise to a staged conflict, as players struggle to achieve the goals of the game [3]. Players have to socially interact to resolve the conflict (i.e. win the game). In the case of children, Berk [13] states that "social conflicts offer children invaluable learning opportunities for social problem solving" and for social problem solving, children must correctly apply several social skills (e.g. encoding and interpreting social signals). Concluding, we argue that by designing the rules of a game in a socially meaningful way, we can offer children a good way for developing and practicing their social skills such as collaboration, problem solving and also competition.

Electronic game development
The introduction of personal computers and electronic games lead to the development of a large number of games that can be classified as *solitary games*. The typical electronic games differ in their nature from the traditional games as they provide a rich medium for new experiences in which the interaction with others and the use of physical objects (i.e. toys) is rarely relevant or required. The main advantages of video games are: a clear goal, an adequate level of complexity, high speed, incorporated instructions, independence from physical laws and provision of rich fantasy world that is able to hold a child's attention through a long period of time [14]. Their main disadvantage stems from the fact that computer games may lead to a child's isolation from the peers and therefore limit the opportunities for a child to develop his or her social skills in a playful manner [15].

The arrival of Internet, mobile and virtual technologies lead to the development of a new genre of electronic games. Network games and consoles such as Nintendo, XBox or PS enabled the children to virtually play with each other and also began to support collaborative learning through virtual environments [16]. Although such games to some extent support interaction between children, they, in fact, stimulate *parallel play* thus the use of similar environment to play alongside others and similarly to the typical electronic games they miss out on the important aspect of supporting children in their social interactions with their peers.

In the recent years researchers have attempted to go further and propose games, in which handheld, pervasive and wireless technologies increasingly become important means to support *group play* in the physical environment. Hendrix et al. [17] proposed a technologically enhanced table-top game called Playground Architect that aimed to stimulate shy children to become more active members of a group. The game succeeded to make withdrawn children more assertive and also showed them the advantages of becoming more socially active. Their results prove a great potential for games to become a tool teaching and enabling children to exercise their social skills.

A different game providing a platform for social interaction between children during a scientific enquiry outdoors was Ambient Wood proposed by Rogers et al [7]. The evaluation showed that exploratory games enhanced with embedded technology supported group reflection and discussion which are inherent characteristics of social collaborative behaviour. Another game, Savannah, built upon location-based technologies, was designed to provide a collaborative experience through an outdoor play [18]. The game evaluation showed ways in which players form groups

during play and discussed technological limitations regarding the possibilities for sharing context and coordinating actions in the technologically-aided games.

Finally, a new genre of technologically enhanced games named Head Up Games (HUGs) was proposed by Soute et al [19]. Such games include "outdoor, co-located, multi-player pervasive games that encourage social interaction, stimulate physical activity and support adaptable rules, creating a fun experience". Examples of such games are: Camelot [20] and Heartbeat [21]. Although the HUGs do not explicitly aim at teaching social skills, one of their goals is to encourage social interaction among children and therefore they provide a good starting point for understanding how games could leverage social skill development in children age 7—10 year old.

In the next section we assess to what extent Head Up Games succeed in leveraging social interactions among children. Moreover, we reflect on what lessons can be taken from their design to inform creation of a new genre of games that enable the children to experience and learn social skills through play.

Head Up Games as a means to support group play

Below we describe two games: Camelot and HeartBeat -- their rules, the way they can be played and also the technology that was used to enhance the collaborative

game experience. Note that each game was developed in a participatory design way, meaning that during the design process, the users played the game and their input was used to inform the next version of the game.

Camelot
In Camelot, children compete in two teams to build a castle. The teams have to gather different types of resources that are spread around in zones on the play field. The first team to complete building their castle wins the game. The game is subdivided in four phases: in each phase, a different part of the castle needs to be built, and each part requires a different combination of resources to be collected. Players can store a limited amount of resources at the castle construction site, for use in a later phase. Players are also allowed to trade resources. Randomly during the game, a ghost appears and tries to steal resources from the teams.

For the purpose of the game small dedicated devices (collectors and zones) were designed to support players acquire resources, store and exchange them. The devices were implemented using PIC micro-controllers supporting the game logic, connected to infrared technology for communication between devices and LED lights to provide feedback to players. Each device functioned as a standalone unit; hence, there was no need for centralized computer control. The collectors weighed very little, so children could easily carry them while running around.

Figure 1: Camelot:
Left and right picture: players running towards the castle after acquiring resources.
Middle picture: building the castle at the castle construction site

HeartBeat
HeartBeat is an adaptation of Capture the Flag with elements of Tag and Hide-and-Seek with the use of bio-feedback as an additional play enhancer. Players are randomly divided into a defending and an attacking team. One defender is in a possession of a virtual treasure and, for the defending team to win, needs to remain untagged. The attacking team wins when the attackers capture the treasure (thus they tag the defender with the virtual treasure). So, the attackers' goal is to hunt down defenders and tag them. Once tagged, a defender must join the attacking team. Defenders can protect the player with the treasure: when a defender teams up with the treasure defendant, both are protected against a single attacker.

Also in this game, small portable devices were designed to support the game (see Figure 2): at the start of the game, the devices randomly assigned players to either the defending or the attacking team. After tagging, a change of a team was effected by docking the attacker device to that of the defender. Using the same interaction technique, the virtual treasure could be passed on between defenders. Biofeedback was incorporated in the game using players' heart rate as input. Each player wore a heart-rate sensor and during the game a player's heart rate was monitored. If the heart rate exceeded a preset value, the player's device would start broadcasting the heart rate to nearby devices of the opposing team, letting them know that

Figure 2: HeartBeat
Picture on the left: Children playing the game
Picture on the right: Game devices, showing team colors.

opponents were near. So, besides running away from attackers, players could avoid being found either by trying to stay out of sight physically or striving to keep down their heart rate to remain 'hidden' virtually.

Games evaluation
During the evaluation of Camelot, no specific method was used to quantify the amount of social interaction. For HeartBeat, the Outdoor Play Observation Scheme (OPOS) [22] was used. However, it proved to be difficult to assess the social interaction with this scheme. We, nonetheless, observed that both games were rich in social interaction: the children were motivated to play together, to form teams, to discuss

strategies and to compete against other children. The interviews with children performed after the games completion showed that fun was derived from these social interactions, especially from team competition, and that the fact that the teams were randomly assigned using the technological elements of the game was seen as an additional advantage of the game itself. The physicality of the games was further seen as pleasurable and the players valued the aspects of social interaction present in the game like teaming-up with other children. In the case of Camelot, fun was also derived from the suspense added by the unpredictable appearance of the ghost. The evaluation of HeartBeat showed that the heart rate sensing was very novel for

the children and had a seemingly positive influence on the game, although evaluation results were not unequivocal.

Discussion

The goal of this study was to assess whether the new genre of Head Up Games provides a good basis for design of games leveraging social skills in children age 7—10 years old and what lessons can be taken from the development of both games to propose new solutions supporting such social skills development. When revisiting Sutton-Smith's [12] overview of social roles in games (presented in Table 2) it becomes visible that different social roles were incorporated in Camelot than in HeartBeat. A very straightforward observation seems to emerge: that HeartBeat supports more varied social interaction comparing to Camelot. However, we argue that in game design it is not the case that "more is better". Games are complex systems that combine not only social interaction, but also other skills, for example physical skills, into meaningful play; therefore merely designing a game so that all social roles are included is simply insufficient. Based on our experience, we argue that besides the social roles that stimulate interaction between children, also the pace of the game has a high impact on the amount of social interaction displayed by the game players. More specifically, if the game is high-paced, similar to sporting competition, the children are not provided enough time for social interaction and therefore more likely to play in isolation from each other.

From the design of Camelot and HeartBeat we have learned that technology can provide advantageous support for games. Children nowadays have come to expect that technology has become ubiquitous, and

Table 2: Social roles according to Sutton-Smith [12] identified in the two examples of Head Up Games: Camelot and HeartBeat

Social Role	Camelot	HeartBeat
Race	X	--
Chase	X	X
Attack	--	X
Capture	X	X
Harassment	--	--
Search	--	X
Rescue	--	X
Seduction	--	--

they value novel interactions in the games. Not only does technology offer novel interactions, it could also support creation of games (and gaming platforms), in which the teacher can choose which player receives what role, and thus can individually direct the social skill development of children (i.e. trying to achieve effects similar to these leveraged in Playground Architect [17]).

Finally, we would like to point at the fact that evaluating any system with children is a challenging task. In the assessment of both games methods such

as observations (through video recordings), interviews and OPOS scheme were used. However, these methods showed several limitations. Due to the outdoor character of the games, the cameras used for an unobtrusive observation were not able to capture all displayed behaviours (as the children tended to disappear from the camera range at different points of the game). Due to this fact, any attempt to quantify the different types of social interaction would not be sufficiently reliable. As an alternative we consider using observers equipped with an observation scheme (next to cameras rather than instead of them) that would simultaneously assess children behaviors and interactions. We also realize that the OPOS scheme needs to be further developed to efficiently and reliably capture data regarding social interactions of children in the game.

Also conducting interviews with children is a difficult task. Children are often easily distracted from the conversation and likely to have difficulties following the scientific reasoning, especially if difficult words and abstractions are used. An alternative way to interview children is to use the methods applied in the socio-metric measures for peer-acceptance which include use of visuals and creation of simple drawings as a means to collect data.

Conclusions

In the first years of schooling, children develop social skills through social interactions with their peers. Therefore, it is important to support such social interactions preferably through play which enables the children to exercise different behavioural patterns. Technological solutions could offer a valuable means to enable that learning process. In this paper we presented two Head Up Games (HUGs): Camelot and HeartBeat and evaluated the extent to which they support social interactions between children during the outplay of the game. Furthermore we discussed the design implications that should be addressed when designing games that explicitly aim at supporting children in social skill development.

Thus far we have been dealing with social interactions and social skills development in a general way, without further elaborating on details specific to that process. In the next step we want to define in a more detailed way what different types of social skills can be practiced in games, and link them to social roles and rules in games.

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