

Effective use of fun with a tangible interaction console

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ABSTRACT

In this paper we describe an electronic console for tangible educational games. Two game applications for children are discussed. We describe why these games are fun and how they enhance the development of social, motor and cognitive skills.

Author Keywords

Educational games, electronic tangible interface.

ACM Classification Keywords

H.5.2. User Interfaces.

INTRODUCTION

In this paper we present our recent work on educational games with an electronic tangible interface. We believe that these games can be strong tools in settings that require learning and intrinsic motivation. We used notions on game heuristics to create fun applications that can support the development of skills; this is described in [1,3]. In the present paper we describe some of our ongoing work on educational games for children, which takes place in the context of a project on the application of sensor technology in toys and games.

TagTiles was developed to investigate game heuristics [2] and to study how tangible electronic board games can support learning. For example, in one of the first tests, we addressed the balance between challenge and control and how this can be used to optimize both enjoyment and learning in an informal learning setting [3]. The interaction console allows assessment of the child's skill level during play, which can enable us to provide the challenge optimal for fun and learning.

We shortly describe the TagTiles game and its evaluation, and a game that was recently developed, based on a modified version of the TagTiles console. We end with a short discussion.

TagTiles

With the game TagTiles we aimed to create a game that is both entertaining and educational. It supports development of several cognitive skills, such as spatial skills and planning. Also dexterity and social skills can be addressed.

The game consists of three playing boards in a row, each with 8 by 8 fields. Two players sit each at one side of the row, facing each other. The game requires the players to

reproduce a pattern of colored tiles, which light up on the central display board (see Figure 1).

An interactive game board is situated in front of each player. The players copy the pattern that appears on the central board by tagging, for each of the tiles that light up, the corresponding tile on their interactive board with an object that has the same color as the illuminated tile. So a tile that turns green at row 3 and column 4 on the display board is reproduced by tagging the tile (3,4) on the interactive board with a green object. Both players have their own distinctive 'right' and 'wrong' sound, indicating a right or a wrong move respectively. The first player to reproduce the pattern correctly wins the game level and the system then automatically continues by starting the next level. The player who wins the most levels is the overall winner.

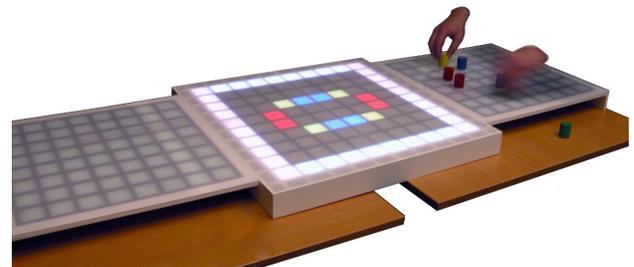


Figure 1. TagTiles game board with pattern displayed in the middle. Colored playing pieces are used to copy the pattern.

Evaluation of this game [3] revealed that 10-12 year old children find TagTiles enjoyable and challenging to play. Interestingly, the level of the challenge turned out to be mainly determined by the skills of the opponent, instead of the game level that was offered. Selection of equally skilled players or providing a way to create 'equal ground' could help to make the game more engaging.

A frequent comment from the children was that they liked the game because it is different from the ones that they are familiar with, as it differs from screen based computer games, and it is more interactive than traditional board games.

The test included two game versions: patterns and sequences. The latter version required players to tag fields in a particular order, according to the displayed example. An interesting observation is that some children were

better at copying patterns whereas others were better at copying sequences. This observation indicates that it is possible to discriminate between the player's strengths and weaknesses in the game, which reveals opportunities for creating challenges that are tailored to the player's skills, even if these are changing over time.

Snake

Based on the TagTiles console we created another game (see figure 2), which is derived from the classic Snake game. We translated this game into a tangible version in which the snake can be manipulated by the user by means of objects. This makes the game more physical, as it requires active manipulation of objects. The snake is represented by a row of lit-up LEDs. Switching lights on at the front of the snake (the head) and off at the tail gives the impression of movement. The task of the player is to collect points by steering the snake over certain targets, which are also represented with LED lights.

The player can change the direction of the snake by placing red 'walls' or blue 'curves' in front of the snake. When the object is detected the squares underneath take its color. The 'walls' make the snake turn around. The 'curves' make the snake change its direction according to the orientation of the angle. Once the snake has gone across all targets the game ends.

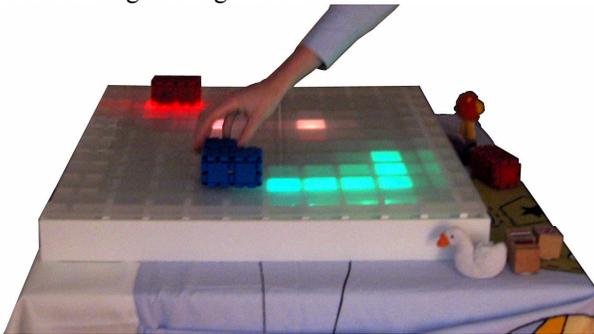


Figure 2. Snake game. The snake is represented by green LED lights and the objects on the board are used to change the direction of the snake.

The traditional screen version of Snake requires fast reaction and anticipation from the player. This is also the case for our version, though the tangible nature of our game requires more physical activity (in particular fine motor skills) from the user than the screen version. Also, the game can have multiple players, which adds a social component to the game experience. Additionally, the light and sound features make the game extra attractive. The game can be elaborated and become more sophisticated by providing objects that bring complex functionality, such as 'teleporting' the snake between two objects, or adding hidden features in the board that can only be found by means of exploration. In this manner, different skills can be targeted such as dexterity, cognitive skills

including attention, memory and planning, and social skills.

DISCUSSION AND CONCLUSIONS

TagTiles consists of one or more grids incorporating sensors, embedded computing and LEDs. This system allows a social (e.g. competition, collaboration), robust (as technology is fully embedded in the playing boards and thus protected) and cheap design, ideally suited for the classroom. The TagTiles console has turned out to be a flexible, versatile platform for creating various educational games. In discussions with educational professionals the potential for training various skills using this console was indeed corroborated. It was recognized as a versatile, intrinsically motivating tool, fit for unassisted use.

Future work

Subsequent studies may address the training effects, both short term and long term. Furthermore, how the player's skills can be assessed and developed during play could be studied. Another topic of investigation may be how the challenge that a game offers (which is considered to be the most important factor to make a game enjoyable, see e.g. [2]) can be tuned to optimize both enjoyment and learning. Assessment will be important in tailoring the game (cq. training) to each individual child, thus offering the optimal challenge and engagement.

Future research efforts may also include how tangible interfaces such as TagTiles could be applied in other settings, for instance, in serious gaming for adults. The same assessment methods we plan to use for children can be used to monitor cognitive decline and provide targeted training for declining skills in elderly. This can be done unobtrusively, for example when elderly are shying away from admitting the problem. Medical applications could include therapy support, e.g. by using physical games to make physical therapy enjoyable.

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