

Virtual Goals: Technology in the Cruyff Courts

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ABSTRACT

The Cruyff courts are very popular outdoor, public sports facilities in The Netherlands, but unfortunately they are not as attractive to girls as they do not like playing with boys. In this paper we describe our attempt to apply new technology into these fields in order to attract girls to them without making them less attractive for boys. Various experiential prototypes were built to test our proposals.

Author Keywords

Interactive technology, girl football, Cruyff court, virtual goals

INTRODUCTION

Playing and sport are one of the most important types of physical activity in children's daily life. At playgrounds, the sport courts are very popular and are used intensively for playing football. It is however strange that these sport courts are hardly used by girls, despite of the strong growth in the popularity of girl football the last few years.

Our design goal is to develop an interactive installation for sport courts and in particular the Cruyff courts. By adding interactive technology to the game of football we want to enhance the playability of the playgrounds. By playability we understand "The extent to which a certain game has the capability to provide enjoyment for a player over an extended period of time" (Kücklich et al). The use of interactive technology should contribute to motivate girls to play on the Cruyff courts along with the boys.

This paper describes our process and outcomes.

DESIGN PROCESS

We will now give an overview of our design process, which describes our approach for developing an interactive football environment for girls and boys alike. In the end of this section a description is given of our final concept proposal.

Target group

Before our idea generation we defined a target group. We

decided to focus on girls aged between 8 and 18 years old. We kept our target group so wide, because football is popular within this whole group of young girls.

Concepts & Experiential Testing

All of our initial ideas were based on the existing football game, without changing the basic rules (a ball, two teams and two goals). By adding an extra dimension to the game, the Cruyff courts will still be accessible for the current users and girls will be attracted as well. We have to keep in mind that the new dimension should give both boys and girls the same chance of winning and enhance the playability of the fields for both of these user groups.

We made a selection of our initial ideas to further develop them into concepts. Figures 1, 2 and 3 provide an overview of our three initial concepts.



"Conquer"

A set of hit sensitive panels set in the perimeter of the field. When a panel is hit, it changes into the color of your team, and thus becomes a target for the opposing team, making it more and more difficult to continue scoring without the other team scoring too. Whoever "takes over" the field by converting all panels wins the game.

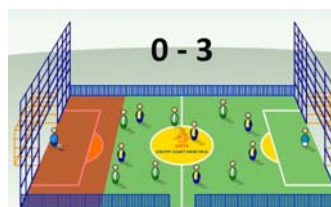
Figure 1. "Conquer" concept



"Virtual Goals"

The physical goals are replaced by hit sensitive walls which act as a giant display for a variety of virtual goals such as moving goals, goals changing randomly in size and position and a goal which reduces its size every time the opposing team scores, to make it harder for them to score again.

Figure 2. "Virtual Goals" concept



"Moving area"

Every time a team scores, an area close to the opposing team's goal will increase in size, A new goal cannot be scored from within this area. This increases the difficulty of scoring as the game progresses.

Figure 3. "Moving area" concept

Although all of these concepts seemed to be promising we conducted *lo-fi* experiential user tests with a girls' football

team and a group of boys, to find out what our potential users find most interesting and exiting about them.



Figure 4. Lo-fi prototype testing with boys and girls.

Concept Evaluation

During the experiential user tests we received very positive feedback towards the ‘virtual goals’ concept and so we decided to develop it further. The girls mentioned that the game gives them the possibility to practice their skills. It also made the football match more challenging, because they had to be aware of the position of the goal all the time. The virtual goals add a time dimension to the goals, which enhances the playability of a football match.

Final concept proposal

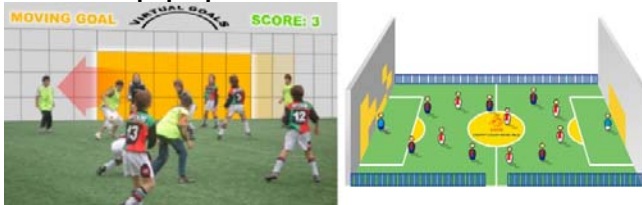


Figure 5. The final Virtual Goals proposal

The ‘Virtual Goals’ consist of two large surfaces with interactive (‘hit’ sensitive) panels on each side of the field in which different types of goals will be displayed, according to what the users choose.

The interactive surfaces work independent of each other, so the users can make combinations of different goal types. The different goal types are explained in table 1.

Goal type	Description
Normal	Regulation size, static goal.
Moving	A goal moving from side to side.
Random	Changing size and position randomly every certain period of time.
Difficulty	Getting smaller after scoring a goal, to increase the difficulty of scoring again.
Conquer	Each panel becomes a separate goal and turns off when hit. The aim is to hit as many as possible and in so doing “clearing” the wall.

Table 1. The goal types available in the prototype.

To make the game even more attractive, after a goal is scored the user is rewarded with a celebration-mode in which audio feedback (e.g. music and compliments for scoring a goal, stadium chants) and visual effects created by the panel lights are generated. There are two modes for

audio feedback and color schemes for the panels, one for boys and one for girls, each with specific sound effects and colors to target each group.

Each virtual goal also has three control panels located to the right and left of the goal area, which will be used to control the system variables (goal type, music mode and reset score). To make changes to these settings, the panels must be hit twice with the ball in a short time period. This is done in such a way to keep them from reacting to accidental hits.

With the ‘Virtual goals’ concept we are meeting the requirements of the design goal in the following way:

- It enhances the playability of the game, by adding an extra variable to the game (different types of goals and a time dimension to them) without adding extra rules or changing the basics of football.
- It’s attractive for girls to play against boys by setting up a combination of different goal types, making it possible to implement a handicap system due to the various difficulties each goal type imposes.
- It supports the learning and training of skills (e.g. awareness and quickness to react).

During the process of further developing the ‘Virtual goals’ we conducted a second usability test. By projecting one of the virtual goals on a wall, girls between 8 and 12 years old and a fellow student could play with it. With this test we wanted to get more insights in our concept so far. We used their feedback to make final adjustments to the installation. Some of the important changes we made are:

- The way of operating the control panels (a clock starts ticking after one hit, thus giving a usecue to the users that they have to hit the panel again)
- More variation in the sounds and music for the celebration modes.



Figure 6. “Wizard of Oz” testing of the concept with a projection

FINAL PROTOTYPE

Prototype proposal

For the real size instalation, the idea is to cover both end sides of the 28 meter wide Cruyff court with light-emitting and hit-detecting panels, measuring 50x50cm each.

Therefore, for our prototype we were planning to build two walls measuring 4 meters in width and one and a half in

height each. Each wall would consist out of 20 translucent panels which contained a light bulb for each primary color (Red, Green and Blue), and a sensor to detect a hit.

Unfortunately because of the limited budget, certain adjustments had to be made to the initial prototype idea to make it simpler and plausible:

- Only a single wall was built.
- The light bulbs as a light source were replaced by a side projection with a beamer.
- The sensors were replaced by layers of aluminium foil glued to both the panels and a supporting structure, and kept apart by a separating material, which when pressed together would make contact and close a circuit.
- We used the circuitry of a computer keyboard as interface to connect the panels to the computer controlling the beamer.

Construction

For the final prototype, a modular construction was chosen. To improve mobility the wall was divided in 4 parts which measured between one and one and a half meter in width and one meter eighty in height. A framework was constructed to keep the wall sturdy and in place.

Panels

Different kinds of materials were tested on their suitability as panels. Cardboard proved to be most suitable since it was flexible while still being sturdy and flat. 2.5 mm cardboard with a white top-layer (to improve light reflectivity) was used. Spray glue was used to attach the aluminium foil to the panels and wall structure to ensure it remained flat.

Screws were used to attach the panels to the wall structure and the aluminium was removed from the cardboard where they were positioned, to prevent any conduction. The material used to keep the panels from touching the wall structure was 1.5 mm thick plastic strips positioned on each panel corner close to the screws, making the panels to bend outwards in the middle and creating a separation between the panels and the wall surface.



Figure 7. Wall construction with the aluminium foil and panels

Computer interface

A dome-switch keyboard was used to connect the panels with the computer. Because the chip inside the keyboard scans for a signal on a combined to pair using a grid of rows and columns, fewer connections have to be made since this layout did not require each key to be wired separately. We used a similar layout for our panels to

optimize the amount of connections and reduce the amount of work (figure 9).

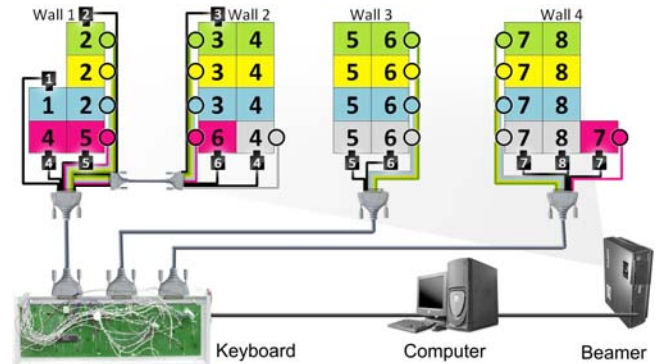


Figure 8. Configuration of the wall and panels circuitry

Input and output

Because of the graphical nature and the ease of use, Adobe Flash was utilized to prototype the output needed for our wall, namely the light received by the panels and the sound played by the speakers. Because the input consisted of plain numbers and letters generated by the keyboard circuitry, no other program had to be used to process the signals.

Position of the beamer

During previous tests the beamer was placed in front of the wall, which caused the players to obstruct the light and thus reducing their visibility. For the final prototype, the beamer was positioned on the side with a small angle between the beamer and wall to avoid this obstruction. The projection perspective had to be corrected for this.

Limitations of the prototype

The prototype can only be used indoors due to the use of a projection.

With only one wall, it is difficult to assess the impact the concept would have on an actual football match environment.

FINAL PROTOTYPE USER TEST

For our final user testing, we set up the prototype in a darkened studio at the faculty of Industrial Design Engineering of the TU Delft.

The users that tested our prototype included some children (from approximately age 6 and above), fellow students and adults.

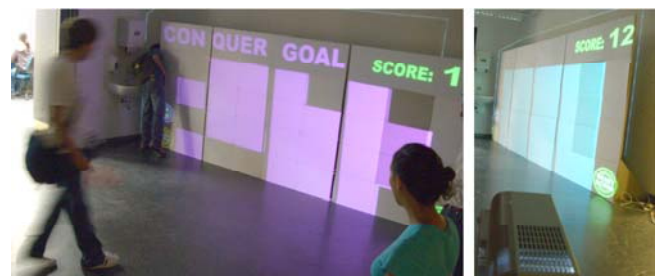


Figure 9. The final prototype and the position of the projection

Results:

We observed that the general experience was different than that which we intended to generate, namely to give the idea of playing “football with a twist”. This was due mainly to the inability of setting up two walls instead of one, which meant that the users were mainly practicing shots against the wall and not playing a football match in which more of the benefits of the virtual goals could be properly seen, such as playing with a different goal type on each side of the field.

Nonetheless we got some positive comments regarding the virtual goals, and the users wanted to keep practicing shots against our wall. Some of them used it as a penalty practice, others preferred the “conquer” goal which allowed them to practice their shot accuracy while trying to hit all the panels.

Regarding the technical aspects of our prototype, we had a bit of a setback with the reliability of the touch sensitive panels, which worked quite well when touched with the hand, but seemed to have trouble sometimes with the ball hitting them. We assume that this was caused by the slow reaction time that the keyboard circuitry needs in order to properly send a signal to the computer.

We noticed that the size of the prototype was adequate enough and allowed the different goal modalities to be easily and properly experienced, especially the “moving” and the “random” goals which needed enough space to fully demonstrate how the difficulty of scoring increases with these type of goals. The position of the projector was also very critical in ensuring that the prototype could be used easily, as it did not interfere with the users while they were playing. Some users even mentioned they were intrigued about the source of the light for the panels, as they could not see the projector at a first glance.

It was also noticed that most of the users did not use the control panels. This could be due to most of them spending a relatively small amount of time with the prototype and not feeling the urge to change goal types and to explore what else was possible. We expect this response to be different on a closer to life situation in which they can spend more time with the virtual goals and in a football match condition.

GENERAL CONCLUSIONS

In general we got very positive feedback in the various user testing sessions that we had, from our initial *lo-fi* experiential prototypes, through our *Wizard of Oz* sessions and our final user testing, as the majority of users thought that it would be a very interesting addition to a football field.

The idea of various goal types was especially well received by the girls’ football team, which thought that it would be very nice to practice their skills and learn new ones, as the varying goals presented an excellent opportunity to develop their game awareness and quickness to react.

The concept seems to be interesting not only for our intended target group of footballing youngsters (from 8 years old and above), but also because of the novelty of our approach (a combination of colorful visuals and audio being added to the football fields) they also remain attractive to younger users.

FINAL RECOMMENDATIONS

There is still a lot of testing to be done with the concept, in order to create a better experience for the users, and to achieve the necessary level to be implemented outdoors in the Cruyff courts. Some of our recommendations on how to develop the project further are listed below.

- The virtual goals act as a giant dot matrix display, which gives the possibility to further develop more visually attractive celebration-modes for the goals.
- Further testing should be made with the use of two virtual goals in an actual football match environment to assess the effect the different goal types can have on the game.
- A separate sound design study should be made to ensure that the audio feedback generated by the virtual goals creates a pleasant and attractive environment for the intended users.
- The complete materialization of the concept is necessary before it can be implemented in an outdoors, public environment such as the Cruyff courts, keeping especial attention to the technology used as being practical, cost effective and resistant.

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REFERENCES

1. Kücklich, Curie Fellow. *Play and playability as key concepts in new media studies*. STeM Centre, Dublin City University.
<http://www.playability.de/Play.pdf>
2. Keyboard Technology
http://en.wikipedia.org/wiki/Keyboard_technology
3. Johan Cruyff Foundation – Cruyff Courts
<http://www.cruyffcourts.nl/>