

# Interfaces for Physical Play – Issues and various solutions

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## **Abstract**

*Gaming is a large industry which has very much been developed around and is dominated by stationary play interfaces, where the player doesn't have to move more than their arms and maybe legs. This has inherent issues and can be seen as a contributing factor to obesity, creating a generation gap between young and old and poor links between the physical and virtual world. There has been a lot of work done around interfaces for physical play which make use of the player moving in the physical space as a means of communicating and playing in the virtual space. This report looks at 6 such interfaces and applications of physical play.*

## **Introduction**

The current mainstream methods of game interaction are very limited and have inherent issue associated with them. Three of these issues will be identified in section 1, with the following two sections looking at solutions to these issues which can be based around physical interaction interface as opposed to following the mainstream and traditional techniques, both in the gaming industry and other industries which can benefit from the technology.

### **1. Issues with Current Gaming Interfaces**

The mainstream gaming today is very much based on the user being stationary in front of a gaming interface, be it a television with a gaming console connected to it or a traditional computer. The user only uses their hands to interface with the game, and in some instances their feet in the case of

some driving simulators, with little or no movement of the body as a whole.

#### **i. Obesity**

“Recent scientific literature reveals a tremendous change in the status of children and adolescents caused by malnutrition and changes in general life style. As many studies show, TV viewing, an inactivity and food taking promoter can be one of the risk factors for obesity in childhood.” This is saying that pastimes which include inactivity, such as watching TV or extended to incorporate playing games where stationary game play is the norm can be detrimental to a child in terms of contributing to obesity. This is in fact a large issue with traditional gaming interfaces and definitely a motivating factor for many in developing new interfaces for physical play.

#### **ii. Generation Gap**

Another issue with regards to traditional gaming techniques is the contrast between the reaction times and stimuli of the younger vs. Older generation. The generation gap is said to be getting larger as children move with the fast paced and ever developing world of computer use, with the elderly being somewhat left behind. Many modern children enjoy playing video games which the elderly people find too fast and frantic to participate in. As the elderly are generally not accustomed to using current gaming interfaces such as the computer keyboard or game controller, they don't get the opportunity to interact with the children on a common ground in a social sense such as partaking in a game. This is therefore another motivating factor in the development of gaming interfaces which are more physical movement based and ability accommodating,

to attempt to bridge this ever growing gap between the generations.

### iii. Physical vs. Virtual World

As mentioned previously, the most common forms of game interaction are the likes of the computer keyboard and other handheld type devices such as game controllers used on gaming consoles like the Sony Playstation. These are not really aligned with the normal human interaction with the physical world, which is largely movement and interaction based, both with other people and the physical artefacts in the physical space. As technology continues to develop further, people are becoming more accustomed to the virtual world in which computers and the internet operate, as well as games themselves. Traditional gaming interfaces do not link well the physical and virtual worlds, and therefore do not promote to the gamer this sense of full stimulation in the gameplay, the final motivation and area of interest with respect to this report and analysis of interfaces for physical play.

## 2. Interfaces for Physical Play

Physical play and interaction with the game is very much a developing field. There are a lot of different interfaces being developed and new game plots with the issues with current gaming interfaces in mind. There are some games being developed which address one of the issues mentioned above exclusively in mind, but due to the nature of the situation, usually there is at least two of them met in each game which will be outlined.

### i. Punch Punch

Obesity being the issue it is in modern society generates a lot of media and public attention, and as such there is some work going on in the gaming world to address the contributing factors and develop a new game and interface to combat the problem. One such example is being designed based on the concept of an embodied interactive interface, as shown in the figure 1. This you can see focuses on increasing physical activity, and therefore

addressing the issues identified with traditional gaming, i.e. largely physical in-activity. The idea of the game developed around this concept is called Punch Punch, and has three stages with increased difficulty and physical interaction required. The aim is to use the body to “hit” virtual food images generated by the game, through the use of a camera and projector type setup where the camera records and digitises the person in the physical space and applies that to the game’s virtual space where the targets exist. It is clear that this game also provides an attempt to bridge the gap between the physical and virtual worlds, as is deemed necessary in the development of physical play interfaces.

The evaluation of this game brought about some interesting findings. The users found that the level of physical activity required was markedly higher than that of conventional gaming interfaces, with some beginning to sweat and gasp. There were some issues brought to the investigators attention though, namely issues between the camera and the users, i.e. the physical and virtual space interaction, which would need to be addressed for further development of the game. This means that the game was successful in increasing the physical activity, and meeting the principle goal of providing an interface which encouraged increased physical activity, and perhaps a reduction in the gaming contribution to obesity. [3]

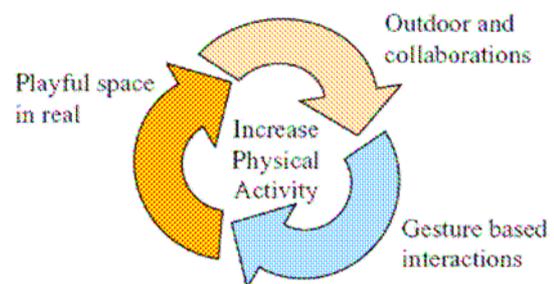


Figure 1: The concept of an embodied user interface [3]

### ii. Age Invaders

The gap between the elderly and the younger generation has been shown to be an issue in terms of their respective abilities to partake in

a mutually stimulating game, in that the reaction times required and general speed of game play makes them out of reach for the older generation. There has been work done towards bridging this gap and introducing a new game and interface to attempt to bridge this gap and developing a product which can be enjoyed by the young and old simultaneously. One game in particular is named Age Invaders, and is based on the traditional computer game Space Invaders.

This has been developed with three main factors in mind. Social and Physical Interactions is the first, i.e. engage the players of the game in physical and social interaction between them whilst playing the game, something shown to be essential for the enjoyment of life and game. Compensation for the differing levels of ability in terms of reaction time and stimulation required has been built in to meet the requirements for different aged players. What this means in real terms is that the parameters of the game can be modified to meet the abilities of the players, i.e. a rocket fired by a child towards an elderly player will travel slower than one fired by the elderly player towards the child, meaning the older player has more time to react and the child has to react faster, giving an increased level of stimuli to the child. The final factor incorporated in this game is the ability for other players to join the game remotely through the internet and interact with the game by placing bonus items and helping particular players gather these items.

The game play itself occurs in a physical space, replicated in the virtual space for the remote players. The physical game will be implemented using many floor tiles with led lights on them to show the players the path they have to travel, and where the rockets are which have been fired. The track for the younger players would be more twisty and demanding, and less so for the elderly players, again accommodating the differing abilities in terms of reaction time etc. This physical game board will interface with the game server to produce a flash client interface for the internet

based players. The game as it has been designed addresses two of the three issues identified with the current gaming interfaces for this report, bridging the gap between the young and old and also the gap between the physical and virtual worlds. [6]

### iii. Unmasking Mister X

Successful interaction between the physical and virtual space is one issue that seems to be more difficult than others with interfaces for physical play, with many possible ways of doing it, some more applicable than others for different situations and game scenarios. One way of doing it is outlined and used in a game called Unmasking Mister X. The idea behind this game and physical play interface is each player having wearable sensors which record the details of the surroundings. The implementation of this game involved each player having a PDA (Personal Digital Assistant) and a sensor board containing a microphone, light sensor, accelerometer, temperature sensor and force sensor. There is one player designated as "Mister X," whose sensor values are sent through a network to all other players and displayed on their PDA. The goal of the game is to identify who is Mister X by travelling around in the physical game space and doing different things to try and isolate the changes in the displayed sensor values. This could be done by going into a dark room and turning the lights on and off for example, or speaking loudly to see what affect this has on Mister X's sensor values. Possible variants of the game include each player being a Mister X, and having to play two roles, both trying to identify who their personal Mister X is and simultaneously trying to minimise activities which will make their own values becoming easily identifiable. This interface is one which seems to be very interesting and takes a different approach to other games in that it doesn't try to relate to the virtual world in more than creating this essentially "virtual" person Mister X, who in reality is nothing more than a physical being identifiable in more advanced ways than humans built in senses. [1]

#### iv. Capture the flag

Another game which uses a similar type of idea as Unmasking Mister X but further develops the interaction between the virtual and physical world is Capture the flag. This game and interface is a digitised version of the popular game which has been around for many years, with the aim of the game to get from your base to the opponents base and pick up the flag located at the base, then return to your base with it, first team back wins. This game differs in that there are two types of player, the knights and the guide. There is at least one knight for each team and only one guide. The knights are the players who move around in the physical world, getting information from their guide and the map on their PDA or Smart Phone, which is connected to a Bluetooth GPS receiver and a Linux-based Bluetooth device. The flag itself in the implemented prototype of the game is a wooden box containing a Linux-based Bluetooth device, used to communicate with the game and report its position. The guides participate in the game from their computer, which shows them a map with the positions of the various players in the game as well as the flags. The guide also sees on their map when the flag has been turned into a bomb or is a potion for example, both tools the opposition can use to try and trick the team into being harmed and penalised by time for example. If a flag has been turned into a bomb for example, the guide has to let the knight know as soon as possible so that he can drop it and get away from it for the two minute period when it is not safe to pick up.

The findings of this experiment were that the game worked best when there were multiple knights in the game and the guide could prove to be a more beneficial player in the game. Also there were limitations on the connectivity of the system when travelling through buildings in the area where the test was carried out. The advantage of this gaming interface is that there is a very large possible play region, limited only by the technology used for communication. The effectiveness of the link between the physical and virtual world is very

high, as there is a virtual world which relates to the physical very strongly – the virtual world is a map of the physical one but there are virtual artefacts in the game which need to be accounted for in the physical world. As this game also involves moving around, and running to be most efficient, there is also a high benefit to children playing this game, as they can be outside moving around yet still play and partake in this computer game. [2]

### 3. Further Thought for Virtual/Physical space interaction

There is also work going into developing links between the physical and virtual space which is being applied outside the realms of gaming itself, and has application in various other industries.

#### i. TeamMATE

The interaction between the physical and virtual world in the previously investigated game scenarios all require that the human is the only type of game “player”, i.e. it is only humans who can partake in the game. TeamMATE is a gaming environment which is being built to interface between the virtual and physical world in another way, where humans and artificial beings can play a game together, with no knowledge between the players who in fact is a real person and who is a virtual player (artificial agent).

The environment built and tested is based upon a boardroom type scenario where there is one player who is the chairperson, and multiple others who are partaking in the meeting discussion. The idea of the game is that you enter the meeting and the chairperson puts to the table an issue, (in the test deciding on a holiday location), to which each person can agree or disagree or be neutral about. There will then be some discussion about the location and the reasons for and against it, after which the chairperson will propose another potential location. This cycle then repeats and then there is a discussion and decision made as to the best option once all

possible locations have been discussed. The game is designed such that each player is completely interchangeable, whether they are a human or artificial agent.

This environment does not specifically fit the definition of an interface for physical play but is an interesting concept which could be applied to other systems to more accurately link the physical and virtual space, especially in a game where the number of players present does not necessarily meet the ideal number for optimum game play. This could be applied in the capture the flag game, where more knights could be added to each team, meaning that the knights really have to listen carefully to their guide in case they are attacked by another knight, which may exist only in the virtual space. [4]

#### ii. Unmanned Vehicle Simulators

Another interesting application of the link between the virtual and physical space is simulating unmanned vehicle activity. There is an argument that there are gaming engines available which can be used to simulate these vehicles in a very "real" feeling virtual environment for testing purposes. This is interesting in the realm of virtual representation of the physical space, with things like accuracy of physics and mapping being strong influences on the appropriateness of a simulator to the required situation. As these gaming engines and simulation interfaces get picked up and developed for military type purposes, there is the strong likelihood that these engines will become stronger and more specific development will take place which will also flow through and benefit the gaming industry and interfaces for physical play.

#### 4. Summary

There is a lot of work going into addressing the inherent issues that arise out of traditional gaming interfaces. The games and interfaces presented here can be seen to overcome issues associated with contributing to obesity and

lacking social and physical interaction as well as the link between the physical and virtual worlds. There are also solutions which can mean the generation gap between the different age groups can be overcome and the issues which arise out of different abilities and stimuli requirements can be met.

#### 5. Future work

The future of interfaces for physical play is a very exciting and full of virtually limitless possibilities. The direction in which this work should be focused is in incorporating the different approaches and looking at putting together all of the solutions to the issues in order to achieve what could be a well rounded gaming solution which incorporates all aspects of physical and social interaction, and in fact lends itself towards more like human interaction.

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