PlayPals: Tangible Interfaces for Remote Communication and Play

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Abstract

Play Pals are a set of wireless figures (like dolls) with their electronic accessories that provide children with a playful way to communicate between remote locations. *Play Pals* is designed for children aged 5-8 to share multimedia experiences and virtual co-presence.

Keywords

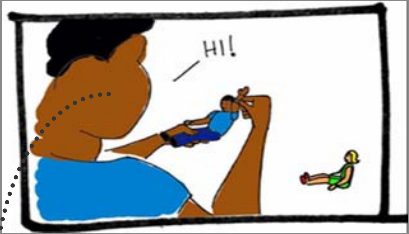
Tangible Interfaces, Remote Play, Toys, Children.

Figurines, the devices which are required for the *PlayPals*

Introduction

Playpals is a system that will augment the already existing co-present play and add another layer of communication to enable a remote co-play and communication.

Play Pals is a system of two or more dolls that are remotely synchronized. When a child at one location moves one doll's hands, the remote synchronized doll moves its hands in the same way. Each child has a set of tangible tokens that are used as the dolls' accessories. When a token is placed in a doll's hands, it functions as a different communicating tool: for example, adding a "walkie-talkie" token to the doll, enables synchronous voice communication.



Playpals can be used to transmit gestures between remotely located children

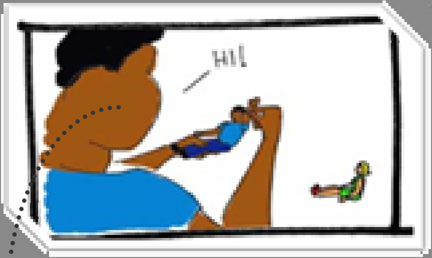
Then there was a pilot study we report on two important observations:

(1)Remote play with no real-time communication capability created an isolated play activity, and the anticipated co-play did not happen.

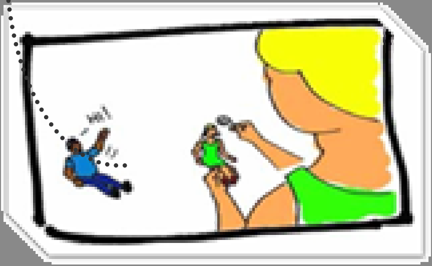
When the synchronized voice channel was added co-play did occur.

(2) The concept of remotely synchronized dolls intrigued the children's imaginations and as a result, it enriched their play and gave them new ways to communicate their thoughts and feelings.

Dolls combined with sound recognition and gesture capture have been designed to retell and share a child's story to enhance the child's emergent literacy skills



The dolls were added with the synchronous voice functionality



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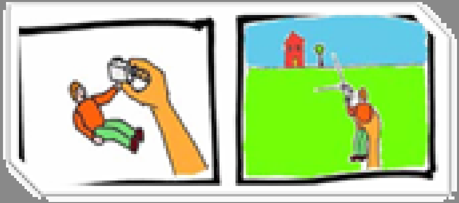
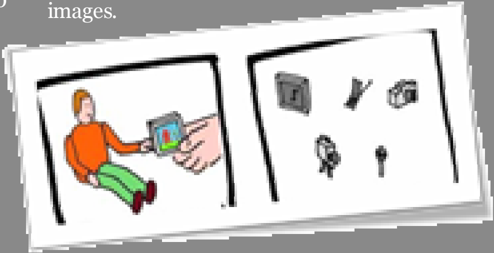
Multi-functions attached to *PlayPals*

Play Pals are a set of two wireless robotic figurines that can communicate wirelessly following different tangible modalities with their electronic accessories.

A set of miniature accessories with specific functions can be used together with the dolls to share a variety of media, a cell phone for synchronous voice communication, microphone for asynchronous voice communication, a video camera for synchronous audio-visual communication and a digital camera for asynchronous visual communication.



PlayPals have accessories that allow them to record, share and display multimedia content, including audio, video and still images.



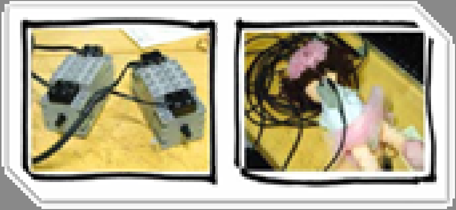
Another child somewhere else receives images and even can talk through the mic.

Prototypes

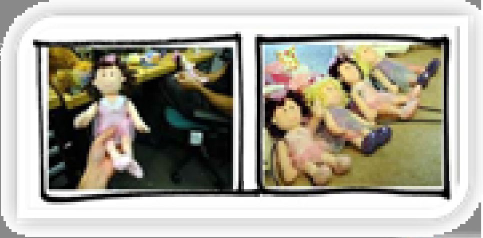
The first prototype of *PlayPals* was built from existing cloth dolls with embedded passive gesture communication.
Each doll has a geared motor installed in each shoulder that acts as a sensor/actuator.

Corresponding arms on a pair of dolls are connected by long cables so that moving one arm on one doll causes the corresponding arm to move on the other doll.

The cell phone token was simulated by giving children headsets with voice over IP communication.



The current prototype of *PlayPals* is based on geared DC motors (upper left) embedded in cloth dolls (upper right) so that the arms move synchronously between pairs of dolls (lower left). Two pairs of connected dolls were built (lower right).



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Pilot Study

Two eight-year-old girls were chosen who used go to school together and play together quite often.
This was divided into three parts:

1. The girls were put in different rooms where they cannot hear each other. Each girl got two dolls; one doll representing herself and the other representing the friend.

2. We added the synchronous voice communication functionality to the dolls and asked the girls to continue playing

3. We moved the girls to a co-presence space and asked them to play with the dolls in the same room

Observations

1. The girls played with the dolls like they play generally pretending the play. From time to time they would see the movement of hand and would respond moving their hands.

2. When synchronous voice command was added, the girls started talking right away with the dolls, about what they are doing and created a virtually shared pretend play. This part was most engaging for them.

3. When the girls were moved to the same room, they started playing with all the dolls and after some time got engaged in other activities.

Play Pals reveal that children using augmented toys for remote play engage in new types of communication.

Interview and Discussion

After the whole session the girls were asked about their experience and how would they use such a system.

Here are the selection of answers:

1. "I like it when one doll moves the other and that its doing the same thing"
2. "I would like, when I talk, that the dolls in the other place would talk with my own voice, but if we are playing they will make their own voices"
3. "I would like my doll to let my friend's doll know when my brother is making me angry"
4. "If I am awake and all my other family is asleep, the dolls can check if my friend is awake too with out waking our parents and then we can play together when everybody else is asleep"
5. "I can have my friend's doll ask my friend's mom something I am too shy to ask my self"

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PingPongPlus: Design of an Athletic-Tangible Interface for Computer-Supported Cooperative Play

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Abstract

This presentation introduces a novel interface for digitally augmented cooperative play created by Tangible Media Group Physics and Media Group and MIT Media Laboratory.

Presented is the concept of the "athletic-tangible interface," a new class of interaction which uses tangible objects and full-body motion in physical spaces with digital augmentation.

Keywords:

- Tangible interface
- Enhanced reality
- Augmented reality
- Interactive surface
- Athletic interaction
- Kinesthetic interaction
- Computer-supported cooperative play

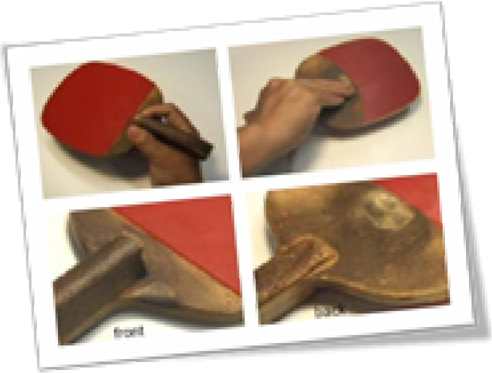
Introduction

Paddle becomes *transparent*, and allows a player to concentrate on the task – playing ping-pong.

The good fit of grasp is vital to making a paddle transparent . To achieve a "good fit," a user has to choose a paddle of the

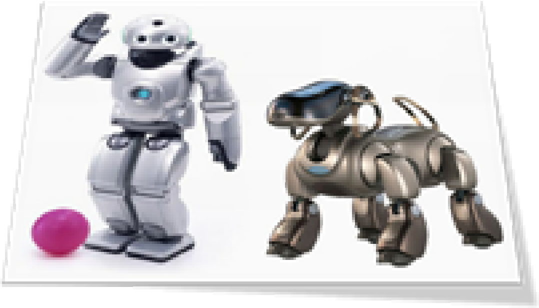
- right size,
- right form
- right weight

By playing sports, people can not only learn athletic skills and develop physical strength, but they can also develop social communication and coordination skills.



Traditional computer games are now extending their reach out from the sole domain of the keyboard, mouse, joystick, and twitch-controllers.

Children can create and teach robots, interact with their dolls, and experience complex skiing and motorcycle simulators. With the rise of networks, in the home and in the arcade, play can occur cooperatively more than ever before.



Goals of the PingPongPlus Project

Goals:

1.To demonstrate an instance of an *athletic-tangible interface*, developed on top of existing skills and protocols of familiar competitive/cooperative play.

2. To develop an underlying technology for an "interactivearchitectural surface" which can track the activities happening on the surface.

3.To study the impact of digital augmentation on the competitive/cooperative nature of play.

Computer-Supported Cooperative Play

CSCP research will guide us to design a new form of HCI that we call the "athletic-tangible interface."

This refers to a new class of interaction that uses tangible objects and full-body motion in physical spaces with digital augmentation

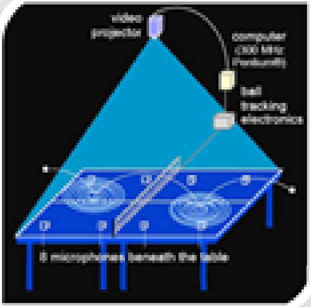
Our athletic-tangible interface research looks at :

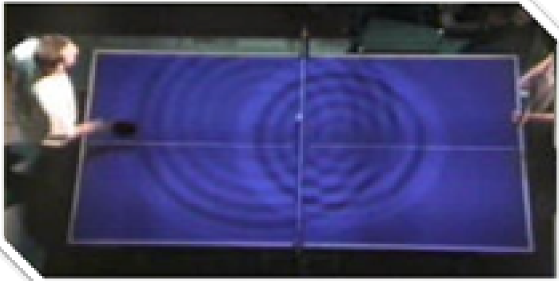
• Augmentation and transformation of *real* sports and games,

We have begun to explore this by adding digital layers of graphics and sound on top of existing skills and protocols of classic games.

Design of PingPongPlus

PingPongPlus is a digitally enhanced ping-pong game using a "reactive table" that incorporates sensing, sound, and projection technologies. The table displays graphics patterns as a game is played, and the rhythm and style of play drives accompanying sound.





With PingPongPlus, users experience dynamic and athletic interactions using:

- Full-body in motion
- A paddle in hand
- A flying ball
- A reactive table

PingPongPlus requires sophisticated realtime coordination among the body, paddle, ball, and digital effects of graphics and sound.

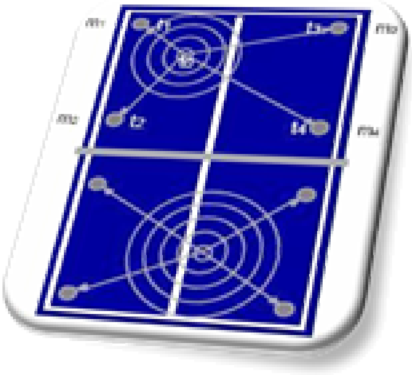
Implementation Technology

The PingPongPlus system consists of :

- Ball-tracking hardware
- Software algorithms for ball-hit location detection
- Graphics projection system.

Ball Tracking System

- Developed a sound-based ball tracking system.
- When a ball hits, the sound travels through the table at roughly twice its speed in air.
- Eight microphones mounted on the underside of the table pick up the sound.
- When a microphone detects a hit, a time value is assigned to that microphone, and it is sent to a computer through a custom-made electronic circuit.



The four microphones (m1, m2, m3, and m4) on the underside of each table top pick up the ball hit sound at different times (t1, t2, t3, and t4).

Hardware Implementation

A custom-built hardware circuit connects the ping-pong table to the computer via the serial port .

This circuit only:

• outputs a microphone number (m1, m2, m3, or m4)
• along with its associated time value (t1, t2, t3, t4).

Software running on a host PC does the rest of the work.

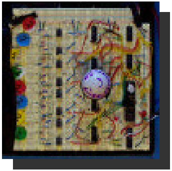


Photo of circuit

Software Algorithms for Location Detection

Software can calculate a ball-hit coordinate in a number of different ways:

• If the ball lands directly at a midpoint between two microphones, the time differences between the two points will be the same (t1 = t2, for instance), and you can infer that the ball landed on a straight line equidistant from those points.

• If the ball lands closer to one microphone than another, it can be inferred that the ball landed on a hyperbolic shaped curve between the two points.

Creation and Projection of Graphics

• They are written in Visual C++ with a custom-made graphics package.

• A projector suspended 20 ft. above the table displays the graphics on to its surface

• Out focused the video projector slightly so that the image became softer and naturally merged into a wooden table surface.

Application

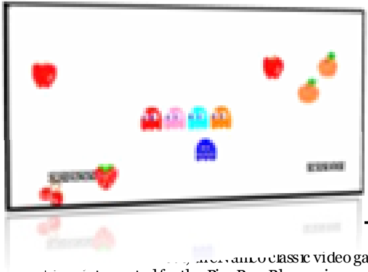
We have designed and implemented over a dozen different application modes on the PingPongPlus table. The goal of our application design was to explore the design space characterized by the two axes:

1) Augmentation vs. transformation,
2) Competition vs. collaboration.

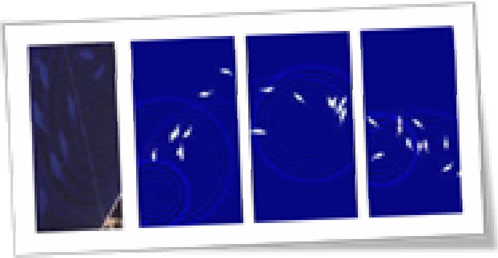
We had two phases of application development

- **Phase 1: 1997 Summer-Fall**
  Artistic and collaborative play modes: water ripples, thunderstorm, spots, painting, comets, etc.

- **Phase 2: 1998 Spring-Summer**
  An enhanced artistic mode (school of fish)



… classic video game is reinterpreted for the PingPongPlus environment



Water Ripples mode
The *Water Ripple* mode is a simple, causal augmentation. When a ball hits the table, an image of a water ripple flows out from the spot the ball landed

Conclusion

We have presented the concept of the athletic-tangible interface through the example of PingPongPlus, an augmented ping-pong table.

We developed new soundbased ball tracking technology that is robust and inexpensive. Through experiments with various application modes, we explored the design space of interactions with special focus on two axes:

- Augmentation vs. transformation
- Competition vs. collaboration.

We expect PingPongPlus to suggest new directions to integrate athletic recreation and social interaction with engaging digital enhancements.

By the augmentation and transformation of physical games, new, engaging interactions can be developed in the physical/digital world.