# The Video Sandbox -Designing an Amplified Playspace for Children

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## ABSTRACT

Much effort is spent using computers and new technology to support children's play and learning. Research stresses the connection between physical motion and language development, and the importance of free fantasy play. But still most computer programs for children offer schoollike tasks to be solved in front of a computer screen.

How should one design computer-augmented playspaces for children that blend into spontaneous play among peers? How can digital media be used to enhance playspaces by adding new dimensions that support collaborative narration?

With the Video Sandbox, we have developed a prototype that combines the sensory and spatial qualities of a traditional sandbox with the magic of sound and images, creating an "amplified" playspace that children quickly learn to navigate and adopt as their own.

## Keywords

Narrative play, amplified reality, young children, tangible interface, collaborative storytelling

## INTRODUCTION

Childrens play and learning is an important focus in HCI development. The pedagogical motivation behind computer-augmented products for children often pushes these in the direction of school-like activites and situations. Much is left to be explored in supporting spontaneous play with computers.

The processes involved in free play are crucial to children's development. There is an important connection between physical movement and spatial comprehension, but also, language development and conceptual thinking reliy on experiences of proprioception and body movement.

The informal, negotiated storytelling in play is also an arena for development of social comptence and the understanding of cultural patterns and discourses.

In the Video Sandbox project we attempted to create a compelling and flexible play environment that makes space for both telling and enacting, and that offer triggers and materials for collaborative storytelling and play.

In the following, we present three important issues in this process: the amplified playspace, collaborative storytelling and creation of imaginary landscapes.

## Amplified Playspaces

What do we want from computer technology? We want it to boost our strengths and give us possibilities we would not have without it. Adding virtual qualities to physical space opens possibilities to amplify the consequences of small movements and simple actions. A metaphor to illustrate this could be a disco dancefloor with lightning and smoke machines. It creates a particular setting that invites actions out of the everyday context. The sound and light change the expression of body movements, and thus invite playful exploration.

So our first question was: how can digital media be used to fuel the aesthetic and narrative experience in a physical playspace, in a way that doesn't constrain childrens spontaneous play patterns?

## **Collaborative Storytelling**

Narration is an important part of play. While playing, children inspire each other to inventing stories. Material and information from all sources get used in this process. One of the outcomes is mastery of language, another is a cultural knowledge.

As Jerome Bruner has described, our cultural framing is expressed in stories shared with the community [1]. By understanding these stories we make them our own, and build our way into a cultural context. The narrative activities in play are dynamic and do not necessarily resemble well-formed stories in a normal sense. And as Roger Shank points out, narrative comprises a wide range of activities ranging from telling to enacting, from construction to deconstruction, from negotiation to immersion [9]. Toys are important agents in this process. Greta Fein has pointed out the linguistic similarities between fantasy play and storytelling [3].

Could children's collaborative storytelling not be about something else then pushing them in the direction of adult storytelling - but rather to offer evocative and flexible spaces and building blocks into the ongoing narrative in play?

## Narrative and imaginary landscapes

An imaginary landscape can serve as both a starting point for narratives and an object for narrative creation in itself. This is a strong feature in contemporary role-playing games [4] and has been pointed out as crucial in many science fiction and fantasy narratives as well:

"There is an older urge than the urge to tell stories. It is the urge to play, and to play with strict rules. I now believe that, even before they started to tell anecdotes to one another, Og and Skag, the first fully franchised human beings, tried to match the number of stones one or the other held in his hand, or raced the salt lick, or enacted some elaborate and forever lost combination of the two contests. And then they told anecdotes, because the game had given them the possibility of a landscape they could control, rather than vice versa, and had thereby given them the possibility of fiction. I want, in other words, to reverse the perspective of these proceedings, and to suggest that imagined landscapes invent stories, rather than the other way around" [6]

Is it possible to create a tool for building this kind of environment that even for quite small children could be an interesting starting point and source of inspiration for play and storytelling?

# RELATED WORK: StoryMat

StoryMat is a play environment aiming to support childrens storytelling and provide possibilities for children isolated by illnesses or other circumstances to be stimulated by other children's stories. The basis is a quilt representing a stylized landscape. Children tell stories about soft stuffed animals that they move about on the quilt. The child's story is recorded together with the movement of the animal. When the right stuffed animal hits a point where a previous story has been recorded, the StoryMat plays the old story. Video projection shows the movement of the animal on the mat.

The issue in StoryMat is to encourage collaborative storytelling. The fragments of old stories inspire children to pursue new stories in their own way. An old story can be interrupted at any point and given a new ending [2].

The Video Sandbox is close to the StoryMat both in its ambitions to support collaborative storytelling and provide an open system which gives space for children's own creative effort. But our take on it is a little different. The Sandbox is an environment which can be built actively and consciously by the children. The collaborative shaping of environments is an important part of the play. And the identification is not linked to any special toy. Any toy or object of the childrens choice can be introduced in the video sandbox, and there is full freedom to switch from telling with toys to enacting. This feature took advantage of video projections that became powerful, theatrical costumes as soon as the children entered the sandbox.

# KidStory

The KidStory Project aims to create tools for collaborative storytelling [5]. Two softwares, KidPad and the Klump, has been developed. KidPad is a drawing tool where two children can draw simultaneously. A powerful zooming function invites travelling in the drawing, thus creating an invitation to narrative elaboration. A new blank space can be zoomed into wherever the story needs one. The Klump is rather an object of storytelling. It is a 3-D object that can be modified in colour, texture and form. Four children can work simultaneously on the Klump, typically telling stories that take the Klump's transformations as a starting point. In this respect, the dynamics explored in the Klump comes very close to the Video Sandbox, with the difference that the Sandbox is about creating environments in physical space.

## Sandplay therapy

In sandplay therapy [8], the sandtray is used as a playspace with the intention to support childrens narrative and language abilities. Replica figures from different origins (real-life persons, action heroes, fairy tale characters) are used as raw materials for the children's world building.

Two ideas behind sandplay therapy have been particularly inspiring to us, although our goal was not therapeutic. The first is the focus on toys and physical objects as a linguistic support to children, a non-verbal language extending the limits of what can be told. The second is the importance accorded to the playspace, the *"free and protected place"* where the child is invited to construct worlds, being the unifying element between otherwise heterogenous objects.

# THE DESIGN PROCESS

We had a quite clear idea of what we wanted to build right from the beginning of the project: an amplified sandbox with vertical video and sound. In parallel with concept development we arranged a series of play sessions with children in order to try certain aspects, notably creating imaginary landscapes and characters from sound. The sessions evolved around four themes:

Soundmap. From sounds to places.

Clay modelling. From sounds to characters

Planet Nuto. Building a fictional place.

The Sandbox. From images/sounds to places.

The design process of the sandbox was not a process of participatory design, if this implies that the children be asked to be codesigners. We visited the kindergarten to have an exchange with the children to make drawings and tell stories together. In the first three design sessions, we had little or no technical support. This meant that we had to rely on telling stories about the scenario. In the fourth session we had a working prototype of the Video Sandbox which could be explored freely by the children in play.

## The Sandbox Concept

Technically, the Video Sandbox is almost trivial: a pointand-click multimedia jigsaw puzzle whose pieces can be dragged around or deleted with the mouse. New pieces are created by clicking at icons at the border of the image, which also provokes the sound of the puzzle piece to be played out. The interactive puzzle consists of six hexagonal pieces. On the sand, they measured about 25 centimeters. The software puzzle is projected onto a "real" sandbox, 130 x 110 cm. large, by a video projector suspended above it. Loudspeakers are hidden under the border of the sandbox. On the border, there is a mouse that controls the puzzle.

## The sandbox interface

Already in a previous research project, Runecast, we developed a similar "vertical video" interface projected on sand and stones. The context in Runecast was a wishing well. Visitors could engage in a dialogue with an underwater fortuneteller by placing stones in the "well". The vertical video projection on sand had a strong visual



Figure 2: The Sandbox Setup

impact, and visitors regardless of age took pleasure in touching the white chisel sand, and forming it in accordance to the projected images.

In the Video Sandbox we reused parts of the physical installation from Runecast: a specially built sandbox with large borders where one can sit or kneel, framing an irregular, rounded sandpit. The video projection area is



Figure 1. The Puzzle pieces

limited to the white sand, with the exception of six thumbnail images of the puzzle pieces, located on the border of the sandbox. Pieces of white paper glued under the projected thumbnail images heightens the contrast to the otherwise dark-blue border.

#### The hexagonal puzzle

Since one of the points of the Video Sandbox is to abolish



the squarish computer screen that separates "real world" from "virtual world" we didn't want to use square shapes in the puzzle. We experimented with two versions, one with different shapes for every puzzle piece, and one with large hexagonal pieces – the latter inspired by beehives and China Checkers. But we soon decided to go on with the hexagonal puzzle and reduce the size of the hexagons, thus inviting to constructing larger shapes out of many pieces.

Image	Sound	Use in play	Comments
Turquoise/Bubbles. Pattern of bubbles with irising reflections. Horizontal	Bubbly water sound. Sensual and tactile	Introduced water theme (transforming the sandbox into a swimmingpool).	Good match between sound and image. Good match between sound and play activity
Red/Worms or hair brins in enlargement. Horizontal	Swirling, a whip or a rope swinging in the air	Favourite pattern used on the children themselves.	Good match sound/image. Good match sound/play activity.
Blue/City skyline. Stylized, flat representation. Vertical	Street soundscape. Many sound sources: cars, horns, steps	Used mainly as a colour. The most used piece overall.	Poor match sound/activity. The verticality of the image made it difficult to use it as representation of a city.
Green/Foliage, green leaves against dark backdrop. Horizontal.	Steps in grass or leaves. No resonance (somewhat dry)	No elaboration on forest theme. Mostly used on the children themselves	Image identified as banana peels, sound as forest. Poor match between sound, image, activity.
Brown/Mountainridge. Vertical. Rich structure.	Metallic crash sound. Poor sound quality. Sharp, short sound with no echo.	Used to add colour to landscapes/mountains	Good match sound/image. Poor match sound/play activity (sound incompatible with falling onto the soft sand).
Yellow/Flower. Naïve painting of a sun or a flower.	Crunching sound of eating an apple	Hardly used in play	The image alludes to children's drawings. No match between sound/image.

Figure 3. Overview of the puzzle pieces and their use in play

## Images and sounds

For the puzzle pieces, we chose images that had references to landscapes, pieces that could represent forest, city, sea, mountains and desert. The level of abstraction of the images varied, as did the style of representation. The six images had distinct colours, which made it easy to refer to them by colour. Soundfiles were associated with the image elements rather intuitively – some connections worked well while others not.

It is difficult to draw conclusions from a rather short test session. Based on a qualitative assessment of the design session which was also documented in video, we have tried to draw some conclusions on the play potential of the different puzzle pieces. The way sounds and images were combined turned out to be important. The sounds that were rather soft and sensual (not contradictory to strange) seemed to work better, probably becaused they matched the tactile play activity in the sandbox.

## **Play Sessions with Children**

In the first design session, three children were given a large paper. With toy figures they explored the white surface, which had different areas of sounds assigned to it. The task of the children was to draw a map based on the sounds. By interpreting the sounds, they invented new characters and events. At the end we had a pretty complex map with places, events and characters. The movement of a character from one point to another on the map yielded a narrative sequence as these scenes were encountered one after another.

Figure 4: The first play session

The sounds were triggered manually by the same researcher that chaired the session. At the end of the session, the children acted more freely, as the rules of the activity and the content of the map became formulated and explicit.

## Modelling characters

7-8 children participated. Starting with sounds, the children were asked to model characters in coloured clay They had paper, pens and coloured clay. We played out sounds, and asked them to make a character that could



correspond to the sound. The outcome of this play session has not been used yet, since we haven't included objects or characters in this implementation of the sandbox.

## Planet Nuto: Building an imaginary place

3 children participated. We started with a large paper. The children were asked to create a fictional place, and explain it in drawings. The place became Planet Nuto. They made drawings of people, animals, homes, schools, means of transportation and so forth. All based on the assumption that everything is different at Planet Nuto, and thus has to be explained.

# The Sandbox play session

Five four-year old children were invited to the studio to try out the video sandbox prototype as described in the previous section. The sandbox was largely self-explaining. After a short introduction, the children took command over the process, and explored the sandbox independently, finding play opportunities we had not foreseen.

During the first stage, they tried out the mouse, and how to make and delete puzzle pieces. During the second stage, they started to play with the sand, making mountains and other forms in it. At first they had difficulties handling the relationship between image and sand – they attempted to "mix" sand of different colours – but quite quickly they handled this dissociation and the placement of images on the sand with self-assurance and aptitude. During the last stage, they experimented with the projections on their own bodies, either by entering the sandbox as an environment, or by using the projections as clothes.

Figure 5-6: The second and fourth play sessions



# EVALUATION OF DESIGN PROCESS AND CONCEPT

We took the decision of conducting the first three playsessions in a very low-tech fashion, mainly because we wanted to test aspects of the play concept before establishing any technical solutions. This was a nice and resource-effective way of working and we got a lot of insights and inspiration from the children. The draw-back of this method was that the first three play-sessions didn't evolve into free play and improvisation, but rather into chaired collaborative storytelling. This was mainly due to the fact that the children recognized that the adult/researcher controlled the process (the sounds) and that we had allocated quite a short time for the sessions . Since apparently the researcher "played" the sounds, there was no incitement to investigate "how it worked" – an important play-trigger in the fourth session.

In this fourth session we had a working prototype of the Video Sandbox which could be explored by the children without adult direction. The exploration of it evolved into a genuine play process.

Another conclusion from the play sessions was the importance of outplaying childrens expectations. The children were used to making drawing and modeling in clay, and when offered these materials they quickly associated them with familiar procedures: making a drawing to take home or put in their personal binder. But the focus for our sessions was not the drawings but the building of imaginary landscapes or creatures. This was most successful in the first and third session, when we used a large, shared paper that the children didn't associate with their ordinary routines of doing and storing individual work. By starting of with questions and



discussions we tried to focus the children on what they wanted to show us, and not on the drawing itself. In the second session however, we didn't manage to keep this focus. Our question to the children – modeling characters to a specific sound – disappeared from their attention as soon as they got involved into building clay figures.

On the other hand the final session was very successful in this matter, since it was completely new and equally challenging to all the children participating, and offered them a genuinly collaborative space right from the beginning.

Also, the final design concept deserves some remarks. It was difficult for the children to keep track of the pointer on a three-dimensional surface, especially when they played inside the sandbox. Another apparently illogical feature was that in order to create a blue puzzle piece, they had to sit by the mouse – at the opposite corner from the blue thumbnail image - and click on the thumbnail image with the pointer. Touching it with your hand didn't work.

Nevertheless, the children quickly got to handle the dissociation between the image projections and the physical space, and then didn't seem to be bothered by it, but used it in creative ways. It also encouraged the collaboration among the children - they all participated in finding the pointer and/or the wanted thumbnail colour - and this might be the reason they were not troubled by the fact that only one child at a time was able to direct the images with the mouse. But the mouse was definitely to difficult to handle (and didn't work too well with sand inside it.) and it will be replaced by a joystick or some kind of larger pointer tool.

## CONCLUSIONS

We wanted to create a playspace that is open to elements from the modern world, which is not recalling a sentimental vision of childhood. We wanted to empower children with powerful and aesthetic tools for expression, and create a place which invites both telling and enacting, where it is possible to alter and change with your hands or with objects when you run out of words, a place that is built on several children being copresent. In this sense we



think the Video Sandbox was successful.

We consider it a prototype for a computer-augmented playspace that is aesthetically rich, reflects changes swiftly, and encourages collaborative creation. Thus giving children a playspace that combines the sensorial and spatial qualities of the sandbox with the magic of sound and images, creating a new kind of magic space that they are eager to investigate and quickly learn to navigate and experiment with.

As already mentioned, the technique behind Video Sandbox is very simple: a point-and-click multimedia jigsaw puzzle. The interest is that this activity happens in the same physical space as the children, and at a size where the children can choose to walk into the puzzle.

Another difference from onscreen media is the amplified visual impact made by the images on the sand. No watercolors or felt pens offer similar possibilities to play around with colours this intense, and at this size. A third novel thing was the possibility to combine 3-dimensional shapes in the sand with the projected image shape, to build into the video image.

We want to stress the importance of the aesthetic qualitites. In the Video Sandbox we deliberately chose visual and audio elements that would not be considered childish or too familiar. The issue is not only to recognize children's right to aesthetic experiences but also to introduce challenging elements in children's storyprocessing and play. The design is made with an artistic intention to introduce strangeness and things yet untold, thus forcing us to enlarge and deepen or language play (in Wittgensteins sense of the word).

We also hope that this design case could demonstrate the fruitfulness in combining the virtual world with the sensual, tactical and visual qualities of natural materials.

# FUTURE DIRECTIONS

The Video Sandbox is a part of a larger project, Narrative Toys, in which we explore the potential of computeraugmented toys in supporting children's storytelling and narrative play[7].

Two system features, central to the underlying thoughts of the Narrative Toys project, were not implemented in the Video Sandbox. Those are the ability of the system to identify/locate objects, and support dynamic assigning of sounds to objects, as well as the ability to evolve over time, as childrens contributions are added to it.

Some of the first three play sessions started to explore these issues in a low-tech fashion. A further development of those ideas are the basis in our upcoming project, the Soundbench.

Figure 7: Children playing with projections on themselves

### ACKNOWLEDGMENTS

The Narrativity Toys Project is funded by the Swedsih Foundation of Strategic Research, through the Swedish Interactive Institute. We thank studiodirector Michael Thomsen, professors Jonas Löwgren and Pelle Ehn as well as multimedia producer Simon Lövind for valuable advice. Special thanks to sound artist Hanna Hartman for kindly providing us with sound material, and to the staff and children of Filifjonkan for their devoted interest and participation in the project. And to our colleagues in the Narrativity and Communication Studio for having patience with the sand in their computers....

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Written in January 2000, updated 2003-05-08 (ÅH)