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soundgarten

A TANGIBLE INTERFACE THAT ENABLES CHILDREN TO RECORD, MODIFY AND ARRANGE SOUND SAMPLES IN A PLAYFUL WAY

Diploma thesis presented by **Michael Wolf**
1rst examiner: Prof. **Gui Bonsiepe**
2nd examiner: Prof. **Günter Horntrich**
University of Applied Sciences Cologne
Department of Design 2002

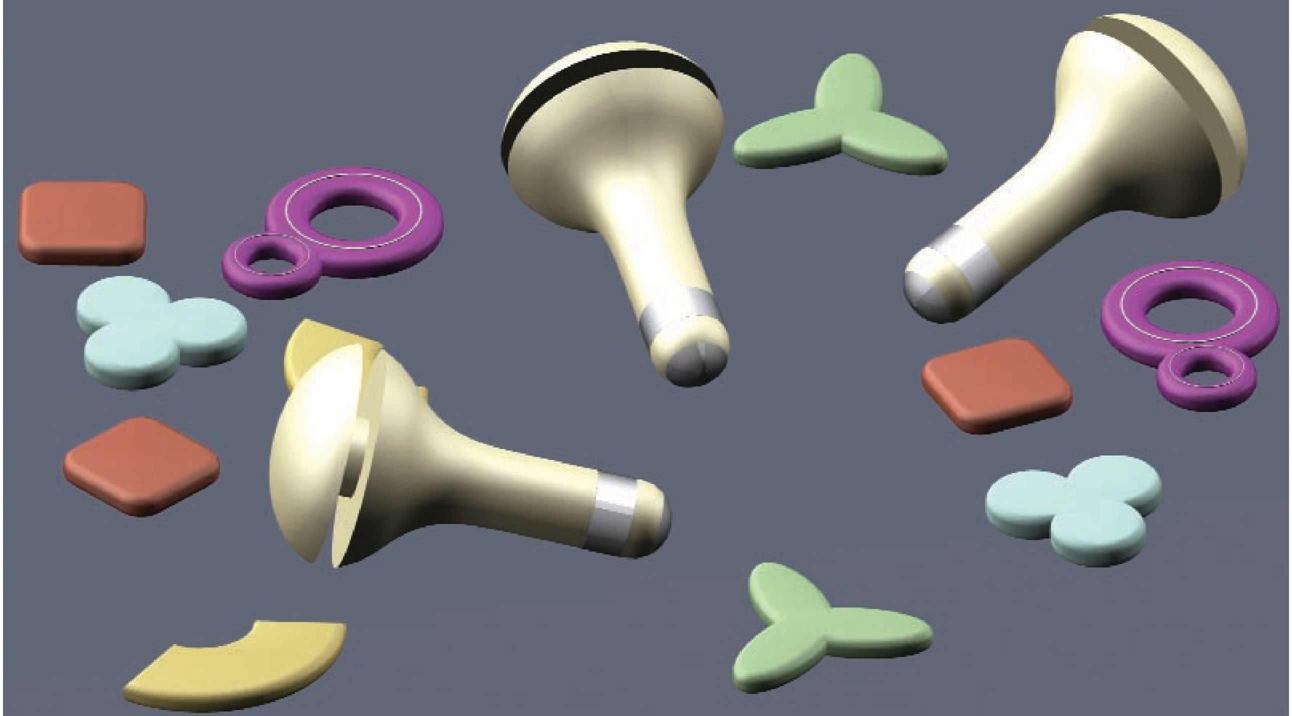

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table of contents

// CHAPTER ONE

// CHAPTER TWO

// CHAPTER THREE

// CHAPTER FOUR

// INTRODUCTION

SOUNDGARTEN is an interactive toy, which allows children, aged from 4 to 6, to record, manipulate and arrange sound samples through play. Taking current concepts of early musical education into account, SOUNDGARTEN encourages playing and learning situations, which allow the exploration and creation of sound scenarios. This documentation presents a model for a haptic-tactile interface, which offers children access to new electronic and digital tools, which eliminate the need to read or to operate a computer as such.
The first chapter of this document describes the principal goals of the SOUNDGARTEN project and is followed by a short summary of topics and approaches in the field of „non-traditional“ interface research. The aims of this project are then situated within the context of current research on the topic. Reference is thus made to related projects dealing with sound and/or children.

In the second chapter it is necessary to highlight certain elements concerning the development of children of this age group. Learning philosophy and methods of early musical education are also discussed. Finally, the role of play and toys on cognitive development in relation to early musical education is studied. By providing examples of „good“ and „bad“ toys in the area of sound, and describing what the market has to offer, the need for the functionalities of SOUNDGARTEN as a tool for early musical education is explained.

In the third chapter, the design process is described from beginning to end. General development/construction processes are taken into account as well as the original ideas on the concept itself and the role of cooperation amongst partners.

The fourth chapter presents the final concept and model of SOUNDGARTEN. The final concept idea, with its different functions, is explained in detail. In addition to examples for various applications and the use of SOUNDGARTEN, technical and formal aesthetic issues are discussed.

Future developments of SOUNDGARTEN conclude this documentation.

// CHAPTER ONE

1 Project Goals

The aim of the SOUNDGARTEN project is to develop an experimental interface for children from 4 to 7 years of age with which they can construct and navigate sound scenarios. The design enables them to digitalize (collect) sounds from their environment and to manipulate them in various ways. Interaction does not necessitate a mouse, a keyboard or a screen. The main goals of SOUNDGARTEN are:

1.1 To produce tools for early musical education and training of acoustic perception

In their first few years, children develop their elementary and most important skills. They learn how to move, to handle objects, to speak and to understand language. This happens through their actions and by experimenting with, observing and imitating their environment. All the senses, especially tactile, visual and auditory perception, play a major role in this period.
Early musical education offers a great variety of approaches for stimulating, practising and teaching sound and music to pre-school children. SOUNDGARTEN provides tools to support the practice of early musical education based on new electronic and digital technologies.

1.2 To encourage collaborative action

A problem with classical „WIMP"- Interfaces (Windows, Mouse, Pointer) is that they hinder, rather than enhance, co-located collaboration. . When children play or work with materials (e.g. building blocks), often several will work simultaneously with a given object. With this in mind, the new interface aims at encouraging collaborative action.

1.3 To develop new approaches in the field of Human Computer Interaction (HCI)

We, the current generation of adults, have grown up with a specific way of dealing with computers. We adapted to the „ways of the machine" more than we adapted the interface to our ways of experiencing the world. The classical Graphical User Interface (GUI) is still an important tool. In terms of usability however, much could be improved. Many researchers and designers have started to look for new approaches toHCI which include the other senses and more „human-like" ways of communicating. Developing „toys for children" in the context of interface design gives more room for experimentation than trying to create an altogether new approach for an already precisely defined application. In designing toys, digital tools included, the adult is asked to „become a child" and to discover the digital world from scratch.

2 Research on „non-traditional" user interfaces

While the influence of digital technology on everyday life grows stronger, offering us new tools, spaces and possibilities, interface designers try to accommodate the demand for digital tools better adapted to „human behaviour." Moving beyond the classical GUI (Graphical User Interface), designersand researchers re-discover the experience of body and space. When these new concepts are applied, the user navigates and interacts with the computer by means of gestures and movement or simply by manipulating physical objects in the same way as he/she did before the introduction of digital tools.

2.1 Augmented Reality

In 1991, Mark Weiser of Xerox-Parc began his article „A Computer for the 21st Century“ written for „Scientific American“ with the words:
„The most profound technologies are those that disappear.“. Here he refers to computers which silently work in the background, become part of our everyday life, and which extend the functionality of our other tools. According to Weiser, interaction with these invisible „workers“ takes place through actions and behaviours, which are well known, to us. He refers to this as the „seamless integration“ of the computer into the physical world. Weiser claims: „They weave themselves into the fabric of everyday life until they are indistinguishable from it.“
He thus describes the emerging „ubiquitous computing“, a concept which has been used and discussed in many models and applications since the early 1990s. Examples such as the „intelligent house“ (in which the fridge automatically orders new food from the supermarket via internet) often lead to uncritical technique euphoria as well as to undifferentiated fear of the „big brother is watching us“ syndrome.

The concept of invisible computers, extending almost every functional aspect of daily life, lead to the concept of „Augmented Reality.“
Instead of developing completely new applications, a group of researchers at the Xerox-Park-Lab, decided to extend the context of existing physical products with computer techniques. Gradually, books and other objects were equipped with tiny chips (electromagnetic ID-Tags), which relate to advanced and dynamic context information. This information is accessible when the object comes close to output media such as printers or screens.

In a project named „Digital Desktop,“ a real physical desktop was equipped with certain functions of a virtual desktop. This made it possible to manually interact with the computer and to use ordinary tools such as a pencil and a rubber. (Note 4) This model made use of a camera tracking system, which sends information to the software about certain moves on the desktop (see video on CD//Video//Wellner.mov). At the same time, the influenced situation was projected from below onto the desktop (Wellner, Newman, 1992.)

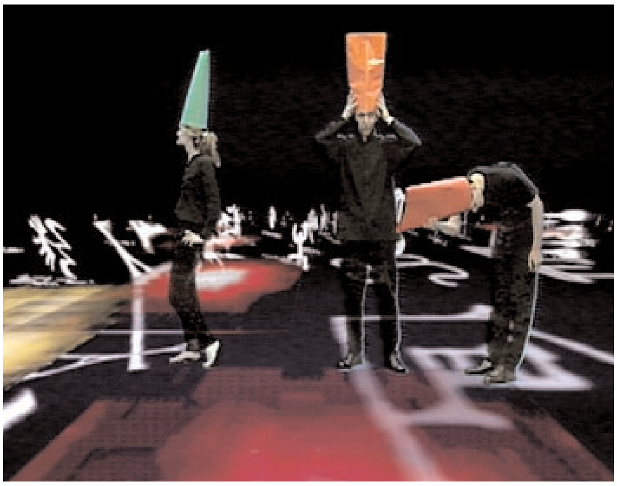
Furthermore, technicians, theatre scientists and artists experimented with interfaces, which could „read“ or interpret gesture and mimic. In „Murmuring Fields“ (pic 1), the visitor of an architectural room is able to navigate through data spaces with full body movement and gesture (see video on CD//Video//mars.mov). The vision of this immersiveinstallation is a room furnished with data (Fleishmann, Strauss, 2000).

2.2 Tangible Interfaces

Ishii und Ullmer from the Tangible Media Group at the Massachusetts Institute of Technology (MIT) focus on the research of haptic-tactile interfaces: „‘Tangible bits’ allow users to ‘grasp and manipulate’ bits in the centre of users’ attention by coupling the bits with everyday physical objects and architectural surfaces.“ (Ishii, 1997).

After a walk through a museum, they concluded that „the aesthetics and rich affordances of these historical scientific instruments, most of which disappeared from schools, laboratories and design studios, and have been replaced with the most general of appliances: personal computers.“
According to Ishii und Ullmer this represent a loss. Their research team at MIT tries to

pic 1: murmuring fields



pic 2: illuminating clay

pic 3: philips pogo

pic 4: musicBottles

(re-)discover the benefits of haptic-tactile experience.

Already in 1995, Hiroshii et al. determined that the use of physical handles combined with conventional direct manipulation techniques, as opposed to using virtual handles, offers inherently richer possibilities (Ishii, 1995). As presented in 1995, their main observations concerning what they called a graspable interface „brick" were that it:

// encourages two-handed interactions;
// shifts to more specialized, context sensitive input devices;
// allows the user more parallel input specification, thereby improving the expressiveness or the communication capacity with the computer;
// takes advantage of our well developed, everyday haptic-tactile abilities for physical object manipulation;
// takes advantage of our keen spatial reasoning skills; and
// enables multi-person, collaborative use.

Many applications recognise the practical qualities of this research. The latest developments include a tool for urban planning and landscape design in which:
a system, called Illuminating Clay (pic 2), allows users to alter the topography of a clay landscape model. The changing geometry is captured in real-time by a ceiling-mounted laser scanner. A depth image of the model serves as input for a library of landscape analysis functions. The results of this analysis are projected back into the workspace and registered with the surfaces of the model (Fitzmaurice, Ishii, Buxton, 2002).

3 Related projects dealing with sound and/or children

3.1 Philips Pogo

Pogo (pic 3) gives children a set of tools including *story cards, a sound mat, story mumbos, a story table, and a composer. Pogo* then encourages the children to create, record and act out their stories. The sound mat contains pockets in which the children place what he calls *memory cards*. When the children step on the mat, the sounds stored on these cards are activated (see video on CD//Vido//pogol-3.mov).

3.2 Toy's Symphony

The Music Toys developed by *Tod Machover* and his team at the *MIT Media Lab* for Toy Symphony are electronic instruments, which can be played without being able to read music or play an instrument. The *Beatbug* is a kind of drum computer that varies its rhythm patterns when someone beats it or bends its two antennas. The *Shaper* is a soft ball-like object equipped with touch sensors. Touching and squeezing the object controls the synthesizer. And *HyperScore* is software that turns drawings into musical compositions (see video on CD//Video//machover.mov).

3.3 Hiroshi Ishii/ musicBottles

musicBottles (pic 4) introduces a tangible interface that deploys bottles as containers and as controls for digital information. The system consists of a specially designed table and three corked bottles that „contain" the sounds of the violin, the cello and the piano from Edouard Lalo's Piano Trio in C Minor, Op. 7. Electromagnetic tags embedded in the bottles enable each one to be wirelessly identified. The opening and closing of a bottle is also detected. When a bottle is placed on the stage area of the table and the cork is removed, the corresponding instrument becomes audible. A pattern of coloured light is rear-projected onto the table's translucent surface to reflect changes in pitch and volume. The interface allows users to structure the experience of the musical composition by physically manipulating the different sound tracks.

4 Conclusion

Recent developments and new approaches in the field of interface research reveal an interesting tendency toward re-discovery of the human senses, in particular haptic-tactile or spatial censoring abilities, which in HCI have as yet been only marginally explored.
The objectives of SOUNDGARTEN relate to many of the goals of current interface research. The SOUNDGARTEN project includes the following topics:

// Tangible/graspable interfaces
// Physical-virtual integration
// User interfaces for invisible and embedded computing/ubiquitous and pervasive computing
// Models of context and context awareness
// Co-located cooperation

// CHAPTER TWO

1 Early Musical Education (EME)

It is generally agreed that musical activity has beneficial effects on psychology and cognitive efficiency. In addition to resulting in the creation of music, it promotes the practise of positive social behaviour (Palmowski/Probst, 1985). Apart from the influence of early musical education on the child's general development, the aim music educationis to awake and develop the musical capacities of a child, i.e. the ability to listen and distinguish between sounds; to sing, play an instrument, etc.
The curriculum for early musical education provided by the Federation of German Music Schools is divided into four parts emphasizing: music practise, music listening, instrument studies and music studies (referred to by Zarius, 1985). Under the heading „elementary instrument play" (music practice) it is explained that instrumental activity happens in a group, a partnership or alone play by imitation, improvisation, reproduction or planned design. The main goals of the curriculum are:

// to develop and experience, recognise and distinguish musical phenomena by means of playful activity with material, objects and instruments

// to acquire basic experiences and abilities in handling instruments

// to experience playing (making music) in a group

// to recognise and show simple principles of order and form in music (e.g. loud-silent, high-low, fast-slow, long-short)

// to develop auditive perception and musical memory

The curriculum section „listening to music" specifies the need :

// to be aware of the sounds of one's environment (e.g. exploring, distinguishing, finding, contrasting, combining, sequencing sounds)
// to describe auditive experiences in

speech and graphical notation

// to listen to and follow extracts of complex compositions.

Since the SOUNDGARDEN project focuses on an active role for the child in listening to and constructing sound environments, the „instrument studies“ and „music studies“ parts of the curriculum, which describe a more passive learning method, are not included.

The *Federation of German Music Schools* curriculum leaves ample room for the interpretation and individual design of EME lessons. Each school and its teachers adapt the curriculum a little differently. Some focus more on movement, others on introducing musical instruments and singing. Considering the core issues of early musical education, it can be presumed that the term 'music' doesn't necessarily play a major role in early musical education (despite its title). The focus lies rather on developing sensitivity and awareness towards the audible environment, introducing knowledge and techniques with which to produce sound and practising and experimenting in groups.

Early musical education can offer a space for children in which they can make full use of their curiosity while exploring music, instruments and sounds.

2 Playing and learning

According to the psychologist *A. Flammer*, human development can be divided into eight phases (Flammer, 1996): He believes that children aged from four to five experience the third phase. In this age group, children systematically explore their environment, develop a strong curiosity and therefore ask many questions. In search for possible identities they act out ideal roles: father, mother, astronaut, princess, etc. At this age, referred to as „pre-school,“ spontaneous designs have a major role in children's play. They express themselves by drawing pictures or act out their experiences in the form of plays. They also often hum melodies or make up the lyrics to entire songs. Their activity is exploratory.

During this period of development, adults and teachers are encouraged to give children enough room to explore the world and find answers to their questions.

According to *Jean Piaget*, cognitive psychologist, children's cognitive abilities develop best when they play an active role in building or constructing their understanding of things, by interacting with objects and situations in their environment.

Children learn best when they:

// Have fun and are attracted by the experience
// Build, act out and manipulate
// Are actively and physically involved
// Communicate within a group situation
// Are free to explore.

For *Jean Jacques Rousseau* (1712-1778), playing is a nature-given method by which children train their perceptive abilities and learn about their capacities as well as about the qualities of their environment and the relation between them. Today, this is referred to as „functional play“ and „explorative learning“ (Hering, 1979).

Jean Piaget was convinced that thinking is stimulated by exploratory play. Following his theory, *Hildegard Hetzer* and *Charlotte Bühler* relate children's play to their cognitive development.

„Functional play“ is exercised during the first two years. During this period, the child learns about his sensory-motor abilities as *pic 5: function play*

pic 6: role & fiction play

pic 7: construction play

pic 8: montessori game

well as the qualities of materials in his environment (pic 5).
In the second stage (children aged from 2-and-half to 5 years), „role and fiction games“ (pic 6) as well as „reception games“ dominate. From the age of 5 „construction games“ (pic 7) become central.
But already from the age of three, children start to develop a capacity to handle material correctly and are able to create objects with a specific goal in mind. Play remains the most important part and not necessarily the goal itself, e.g. when a three-year old child wants to build a tower using building blocks the chances are that it turns out to be a house in the end.

3. The use of toys

The importance of pre-defined toys is controversial. It appears as though children do not necessarily relate to the design of toys in the same way adults do. A good example of this is the young child on Christmas Eve who has more fun with the wrapping paper than with the perfectly designed toy. A visit to a toyshop suffices to confirm this theory. Most toys being designed by adults reflect the feelings adults have for their own childhood rather than the reality of the child's play. For example, when adults buy enormous teddy bears the thing sometimes frightens their children. While for the adult, the very same object brings back the notion of dimensions corresponding to when he or she was a child. For some adults their children are nothing more than a tiny reproduction of themselves. Toy design often reproduces a miniature version of the adult world; take a mini workshop complete with a miniature drill, a chain saw, etc. Childlike play and toys are dominated by adult interpretations of the world. In his article „What's left from playing,“ *Franco La Cecla* criticises the modern toy industry. He claims that through toys adults force childhood into pre-defined meanings. Instead of supporting the child's search for his or her own identity, adults confront children with what they consider to be ideal entities. As an example, he quotes the slogan of a „Barbie“ advertisement: „Now Barbie is like you, now you can even swap clothes!“ La Cecla reflects on long-gone times when children were invited to invent a name for their doll themselves (La Cecla 1997).

A frequent mistake in toy design is in the production of toys that confront children with static or „closed“ concepts; toys that tell only one story and don't leave room for free interpretation. *Walter Benjamin* criticises:
„Pedantisch über Herstellung von Gegenständen, Anschauungsmitteln, Spielzeug oder Büchern, die sich für Kinder eignen sollen, zu grübeln, ist töricht. Seit der Aufklärung ist das eine der muffigsten Spekulationen der Pädagogen. Ihre Vergaffung in Psychologie hindert sie zu erkennen, das die Erde voll von den unvergleichlichsten Gegenständen kindlicher Aufmerksamkeit und Übung ist. Von den bestimmtesten. Kinder nämlich sind auf besondere Weise geneigt, jedwede Arbeitsstätte aufzusuchen, wo sichtbar die Betätigung an Dingen vor sich geht. Sie fühlen sich unwiederstehlich vom Abfall angezogen...“ (Benjamin 1972).

Nonetheless, adult guidance and thus a certain degree of influence on the child's development cannot altogether be excluded and is certainly necessary. In the first great civilisations of human history, dating back some 4000 years, adults designed toys for children. These artefacts typically represented and introduced adult culture to the child and were also explicitly used for didactic and pedagogical purposes. Toys are and have always been an initiation to adult culture.
From a pedagogical point of view, toys can

serve diverse functions regarding a child's development. The „Workgroup for Quality Toys“ published a book with a functional categorisation of toys.
It distinguishes: (a) toys to move, (b) toys to love, (c) toys for role plays, (d) toys to design, construct and research, and (e) toys for group play (referred to in Hering 1979). According to this categorisation, there are specialised toys to enhance motor abilities, communication or creativity.

The *Montessori* method focuses on material and objects which deal with mathematical-spatial relations, for example, objects that fit in holes of a certain size (pic 8). Playing with building blocks, clay or water, the older child learns about the properties of objects, form, size and structure. It is generally agreed that play activities such as these (found in almost every nursery of the western world) have a positive effect on cognitive development. From the early 1960s on, abstract construction toys such as *Lego, Meccano and Fisher Techniques* became very popular. The idea was not to confront children with „closed concepts“ but rather to offer them a „repertoire“ in order to create their own objects and toys.

For *Mike Scaife* there is another reason, which makes artefacts important for children. He believes that the most important skill for a child to learn is that of understanding symbolic systems such as language, numbers, music and art. During the first two years of life, children don't differentiate between objects and symbol. Scaife thinks that toys and other objects play an important role in helping children to understand the nature of symbols. In a role-play, for example, children can learn to differentiate between a stick, which becomes a horse in a game, from a real horse (Scaife, 1997).

4 Toys that relate to sound

According to *Walter Benjamin*, almost any sound producing object can become a „sound toy“ for children. Metal pots become a drum set, just as a stick rattled along a garden fence can make a lot of noise. Simply experimenting with the sound that bottles filled with different amounts of water make when struck could be an interesting activity for an EME-class.
There are, of course, already a variety of sound toys available on the toy market, which are worth considering with regard to the goals of EME presented above.

4.1 Sound memory

Small boxes (film boxes) are filled with materials that will produce a different sound effect when shaken. Each box has a pair. The object of the game is to find the pairs by using listening skills. The game enhances auditory perception (pic 9).

4.2 Where does the sound belong?

The sound of different instruments and sounds taken from the environment and from nature are stored on an audiocassette. Children are asked to match the sounds to representations of the sounds on picture cards (pic 10).

4.3 Table drum

Generally speaking, rhythm instruments are very suitable for children between the age of four to six. They are easy to play (success is obtained much faster with a drum than with a violin, for example) and they require a lot of physical movement as input.
The big table drum is attractive in particular because its low frequencies cause tactile-perceptible vibrations. Another plus is that a

pic 9: sound memory

pic 10: Where does the sound belong?

pic 11: table drum

pic 12: paletto

group of children can stand around the table and play together. It is therefore appropriate for group activity (pic 11).

4.4 Keyboard mat

This electronic toy is a big polyurethane mat with a keyboard that the child steps on to produce musical notes. Like the table drum, sound is again related to movement. Children can „hop onto“ the piano. Disadvantages of this toy are that the electronic sound is of only mediocre quality, and the sound spectrum is very limited.

4.5 Paletto

A manufacturer of therapeutic toys offers a game consisting of 8 coloured pads and a speaker mechanism. Different sounds are activated by touching the pads. Each pad can produce eight distinct sounds which are related to specific topics; thus Paletto can make a total of 64 sounds altogether). The topics are musical, environmental and nature sounds. Ads for this product claim a variety of benefits; in particular, that Paletto reinforces the ability to concentrate, to remember, to coordinate and to associate. Further, the manufacturer recommends using Paletto to set role-plays and stories to sound. Disadvantage: even 64 different sounds become boring with time. The functions are very limited and the sound banks are not expandable (pic 12).

4.6 Sound blocks

„Sound blocks“ is the only sound toy I found that relates the composition of sound and music to spatial constructing. The interface is very interesting because it assembles sound, colour and form. Five cubes are placed into holes of the same size. Each side of a cube refers to a different melody or rhythm line. With the sound blocks a child can compose different music tracks by manipulating physical objects. Still, like Paletto, the possibilities are limited. It is another closed system.

4.7 Karaoke tape recorder

Tape recorders equipped with a microphone have over the years become very popular in nurseries. Children love to hear their own voices or to sing along with a microphone in their hands just like a pop star. They also have great fun recording their own voices or other noises and listening to such recordings again and again.
Compared to these very expensive examples of pedagogically valuable toys (toys like Paletto cost up to 1600 EUR), which were found in specialised catalogues for kindergarten and pre-school equipment, the reality of common toy shops is quite different.

The sound toys found in a „ToysR’Us“ store usually produce low quality synthetic sounds, which are triggered by pressing a button. These toys are very limited in terms of use and do not promote creative, developing play. Consider, for example, the large variety of puppets and dolls which when touched or squeezed can say their names or a limited number of phrases. The „speaking doll“ could frankly be considered a „fantasy killer.“ These and other toys hinder what should be an opportunity for children to develop their own character and to express themselves verbally. The initial attraction for, or „sensation“ related to, a speaking doll is soon replaced by boredom. More promising, are the latest studies done by Microsoft on a interactive toy bear by the name of Barny. This bear assists the child in handling a graphical computer Interface, relating to diverse contexts. These „smart“ toys have a capacity of up to 4000 words.

Very popular and also more promising sound toys, although less or even non-functional, are miniature versions of real instruments, for example, a small keyboard which plays a whole melody and not just a single note when a key is pressed.

If parents were to listen to advice given by the „Stiftung Warentest," chances are they would never buy any of these electronic sound toys. This product-testing institute suggests:" Before you buy a toy, hold it against your ear. If the sound is unpleasant to you, don't confront your child with it."

5 Tools for early musical education

According to literature and various observations, the tools used in early musical education are typically restricted to classical musical instruments, sound-producing objects of everyday life and tape recorders or other hi-fi equipment.

The use of a tape recorder makes it possible to capture environmental or self-produced sounds. This can be advantageous for the learning sequels „distinguishing or classifying sound". The playback function provides the possibility of playing a musical element or of transporting sounds from other environments into the kindergarten or classroom. The big disadvantage of a tape recorder however is that it can only play sounds in a linear manner as they were recorded. It is not possible to modify or arrange the captured sounds. For a long time, this capability could only be provided by advanced studio technology.

Today, every PC is equipped with sound software, which enables the user to modify and arrange sound samples at leisure. Nevertheless, within the context of early musical education and computers, certain hurdles remain.
A classical WIMP-interface is not suitable for group activities. No appropriate sound sampling software for children currently exists. Furthermore, there is no digital recording tool that can be easily operated by children.
In discussing the topic with two early musical educators, it was apparent that such a tool, which could enable a group ofl 4-year-olds to experiment simultaneously with sound (to capture sound samples, manipulate and arrange them independently of one another), would be extremely encouraging.

6 Conclusion

The goals of early musical education are set in relation to agreements on learning methods and the level of development of children between 4 and 6 years of age. They main goals are to teach children to imitate, improvise, reproduce and plan the design of sound.

According to Piaget and other educators, children of this age group develop their cognitive abilities while actively handling and manipulating objects and freely exploring their environment.
Toys these days often offer possibilities for use which are too restricting and often „narrow-minded". Children are confronted with perfectly defined artefacts or closed systems that are fly in the face of both the theory and the reality of children's play.
With regard to current EME and sound toys, electronic and digital technology has not yet been applied efficiently and thus remains much less useful than expected. The fact remains that very few tools available on today's market allow children to capture, to manipulate and to organise sound through play.

// CHAPTER THREE

1 The general work process

Before explaining the final concept and the model of SOUNDGARTEN, it will be helpful to briefly describe how this project was developed. Several conceptual studies, which led to the final concept, also need to be described.

The main goals of SOUNDGARTEN were decided upon at the beginning of April 2002. A framework of three months remained to work on the project itself.

A website (http://wolf.formlos.com/sounkueche) piloted this project from beginning to end. The website, regularly updated, provided information on new developments and research results inviting discussion from both professors *Gui Bonsiepe* and *Günter Horntrich*, as well as designers and partners at *MARS-lab*. The website contained a general description of the project, a section called „work in progress“, a forum for comments and online discussions. The concept of working through a website represented a major advantage and helped in structuring the work process and the different phases of development of the project. It meant presenting summaries of the state of art from time to time. However, the forum was replaced by telephone discussions, emails and face-to-face discussions.

The interest and support shown by *MARS-Lab/IMK at Fraunhofer*, St.Augustin for this project proved to be a determining factor. The opportunity of working with MARS two days a week, and notably, the invaluable input of *Yinlin Li*, an electronics engineer, and *Christoph Groenegress*, a computer scientist, helped to make SOUNDGARTEN technically possible. Under a tight schedule, the duties and responsibilities of the project were clearly defined: Li was responsible for the electronics and Christoph for the software development. *Monika Fleischmann*, Directress of MARS, and *Wolfgang Strauss*, a media architect, provided information, discussion and feedback.
All the conceptual and formal aesthetic issues, as well as the project process, remained to be my part.

2 Conceptual studies

2.1 To collect and to tinker

The first working title of the SOUNDGARTEN project was „to collect and to tinker“. While observing children and their way of dealing with the world, it was clear that to them, these two actions were synonymous. Children would grab a bucket, a net, an empty glass and a shuffle collecting things they found worthy to carry home. Then they would tinker with these objects, combine them and create something new to show their interpretation of the world. At the beginning stages of the project therefore, the elements, ‘bucket’ and ‘shuffle’ were considered. The initial idea of sound being carried in a bukket, as if it were a material, was interesting. But how the collected sound would later be manipulated by children remained a to be solved.

2.2 Sound kitchen

A photograph of two children sitting at a kitchen table mixing something in a pot inspired the „kitchen“ metaphor (pic 13). The picture showed the children collaborating and having fun. The basics of cooking (mixing ingredients together) are easy to understand. So why not cooking up sound?
The concept for SOUNDKÜCHE was based on the simple idea of adding and removing

„sound ingredients“ (symbolised by physical objects) to and from a pot, thus creating individual mixes. In placing a certain object in the pot or bowl, a certain sound would be played. The sound objects would represent single sounds, like a rhythm line or a melody. But these objects could naturally also represent environmental sounds such as wind, rain or animal cries. With this given repertoire, children could build their own songs or acoustic environments by combining the different „ingredients“.
This concept also offers the possibility of collecting new sounds using certain „joker objects“. With these objects children could record their own voice, and additionally, they could take the object with them and record additional sounds. After capturing a sound, they could then bring it home and play with it, integrating it in their sound scenario.
The concept utilized the sound items in the pre-defined sound banks, augmented by sounds that the children gathered from their environment.
However this idea was excluded for two reasons: first, *Philips Pogo* had already used a similar concept which consisted in dropping cards into a pot, which in turn processed either pictures or sounds. Second, the on/off function seemed a little too simple: there was too much resemblance to dropping a coin in a jukebox. Once again, the concept did not provide the opportunity of modifying sound samples.
I programmed a virtual model (macromedia director) with movable graphical symbols corresponding to the physical objects served to show the functionality of this concept (see on CD // interactive model/ soundkueche).

2.3 Sound fish

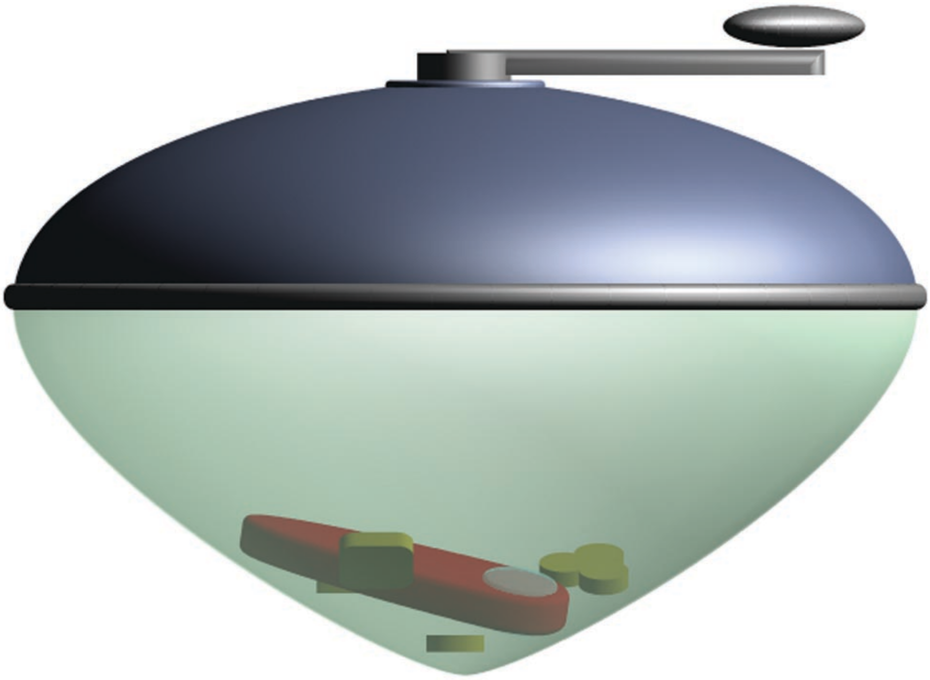
The next idea was more complex and proved to be too complicated. In looking for a way of not only handling single sound objects independently from each other but also putting them into relation with one another, the idea of a pot was replaced by that of several boxes. Each box had the function of a player. By placing a sound object in the box, the stored sound would become audible. Dropping other items with the sound object into the same box could control features such as volume and pitch. The size of the box would also have an effect on the duration of the sound.
For more advanced players, the sound boxes including the objects could be arranged next to or behind each other. In this way sounds can be „clustered“ together, played one after the other or at the same time (pics 15-16).

2.4 Gyroscope

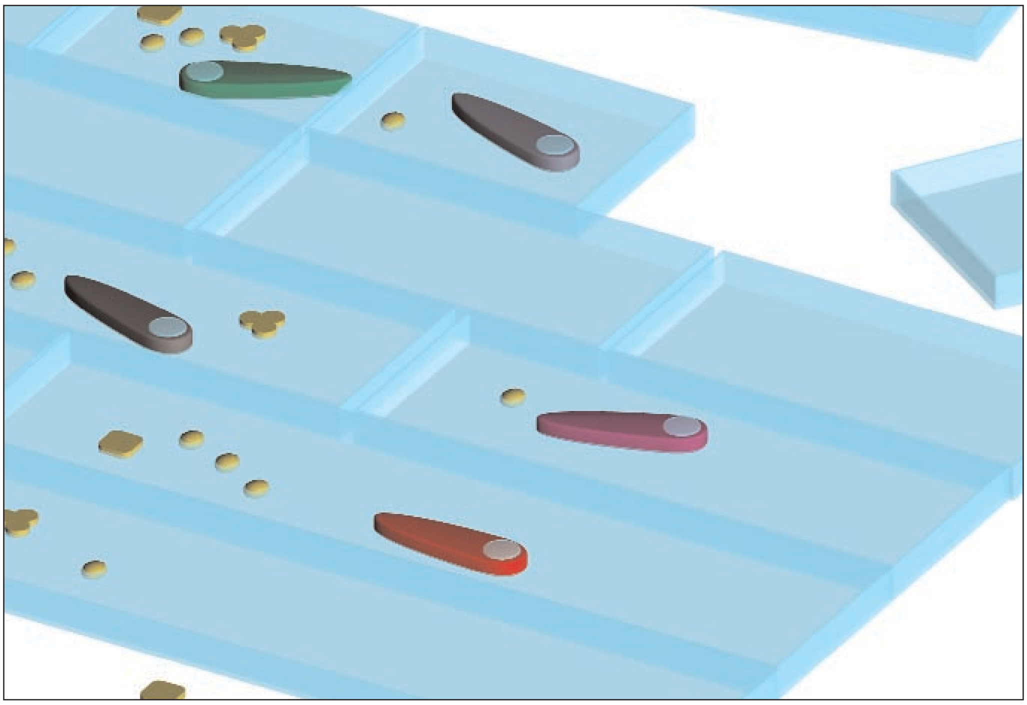
The concept of a „gyroscope“ came about as the result of the search for a simpler idea that would also incorporate movement. This basically amounted to a variation of the bowl metaphor. It strongly resembled an old sound-producing toy, which functions mechanically: by turning the handle on the top of the object different sounds or melodies were produced. The difference was that with this new version, sounds and effects (represented by objects) had to be physically placed in the gyroscope. The action of „mixing“ the objects together by turning the handle made the sounds audible. According to the turning speed, playback speed or volume pitch could also be selected (pic 14).
The Gyroscope included body movement but had several drawbacks. Although interactive games would be possible, each gyroscope could only be used by one child at a time and thus excluded co-operation or veritable group interaction. The other disadvantage is that the sound scenario could not be changed dynamically while turning the handle. This meant that each time the sound scenarios were changed, one had to stop the

pic 13: children cooking

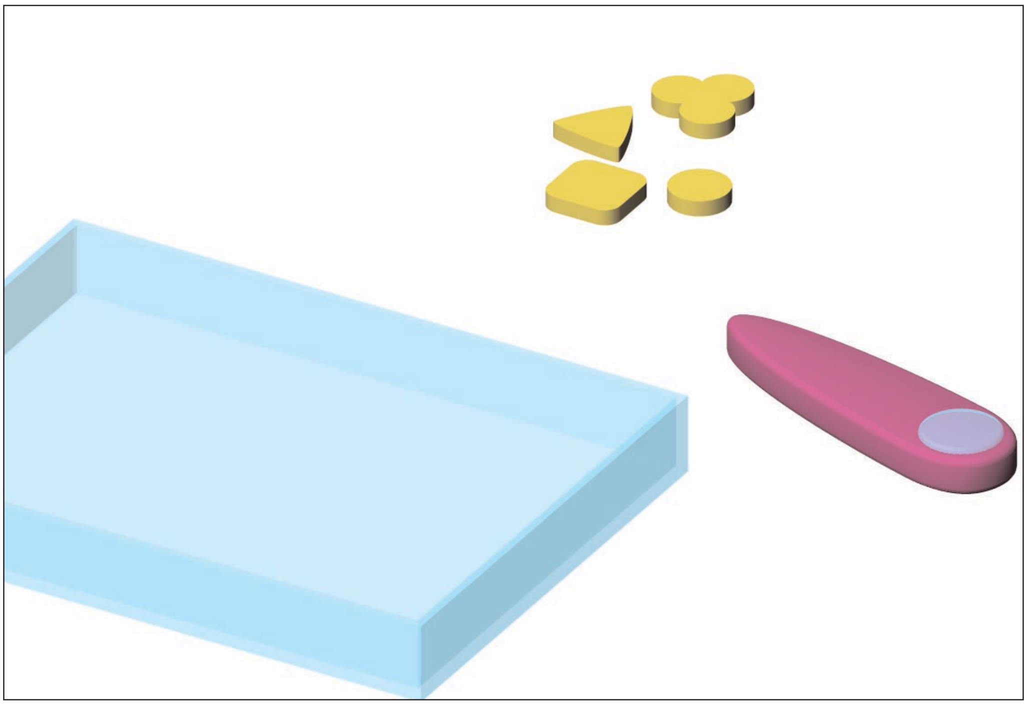
pic 14: gyroscope



pic 15: sound fish



pic 16: box, sound objects and attributes



movement so new items could be loaded into the gyroscope.

2.6 The garden metaphor

Neither a bowl nor boxes provided a veritably collective interaction space. Rather than a bowl, the interaction space needed to resemble a stage or a dome. The idea of a landscape developed: what if adding and removing sound plants could alter a sound landscape? In the first stage of the garden concept, a variety of plants were assembled to represent different sound sources.

2.5.1 Flower

The „flower“ (pic 19) symbolized a predefined sound. This could be any sound of the environment, e.g. wind, a car, animals, voices. „Flowers“ are of different colours, which each represent a certain „sound class“, i.e. long sounds or short sounds. A graphic symbol in the centre of the flower enables the child to distinguish between the different sound objects. By adding the „flower“ to the garden the corresponding sound is activated.

2.5.2 Mushroom

The „mushroom“ (pic 18) is the recording tool and can be carried away to record sound samples. Squeezing the lower part of the mushroom triggers the recording action. The recording is stopped by squeezing it a second time and the sound sample is played back once in low quality. By adding the „mushroom“ to the garden the recorded sound is played back, this time in good quality.

2.5.3 Singing ivy

„Singing ivy“ (pic 20) is an example of a musical instrument which can be played within a sound garden. It produces sounds based on Lew Theremin's principle. The „Theremin“ was the first electronic musical instrument. It produces electrostatic fields, which are influenced by organic material such as the human body. Movement is transformed into the typical „Theremin singing“.

2.5.4 Rhythm root

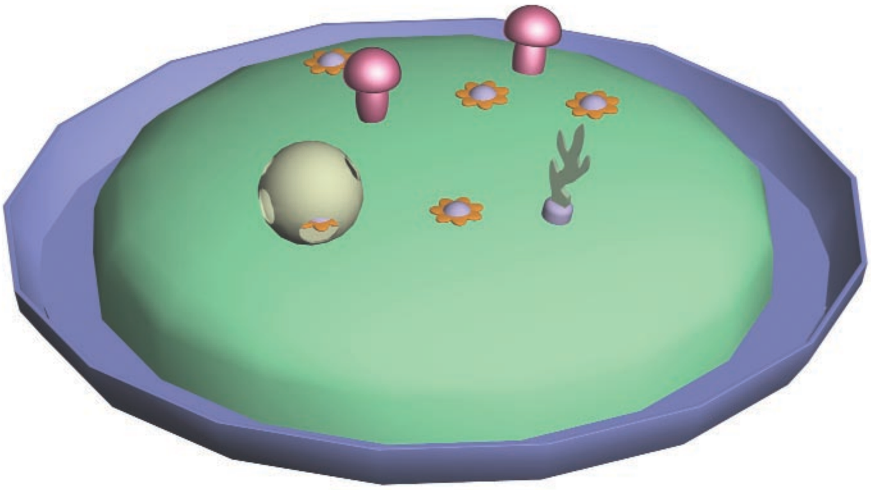
„Rhythm root“ (pic 22) has some of the functions of a simple drum computer. The different „branches“ can be bent in all directions. By manipulating the object, different rhythm patterns appear and can be modified dynamically.

2.5.5 Echo cave

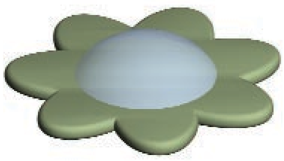
„Echo cave“ (pic 21) is an example of a sound filter (here: echo effect) which can be applied to a sound by putting the „echo cave“ over a sound object (i.e. mushroom). The shell-like shape has holes, which allow one to see the object that lies below it.
The garden metaphor can incorporate many more sounds and musical elements.

Although these different elements were initially viewed as a valuable aspect of the concept, it seemed necessary to restrict the number of functions and to focus on the central idea (i.e. recording, manipulating and arranging sound). The diversity of tools within one sound interface seemed to distract from the principal goal and became merely an assortment of different instruments, each with an individual „behaviour“ and design. Apart from which, the interface doesn't give enough visual feedback according to the changes of the sound situation. In terms of the task „context awareness“, it would be necessary for the objects to change their shape.

pic 17: first soundgarten concept

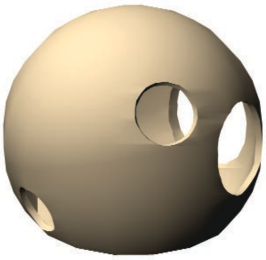


pic 18: mushroom



pic 19: flower

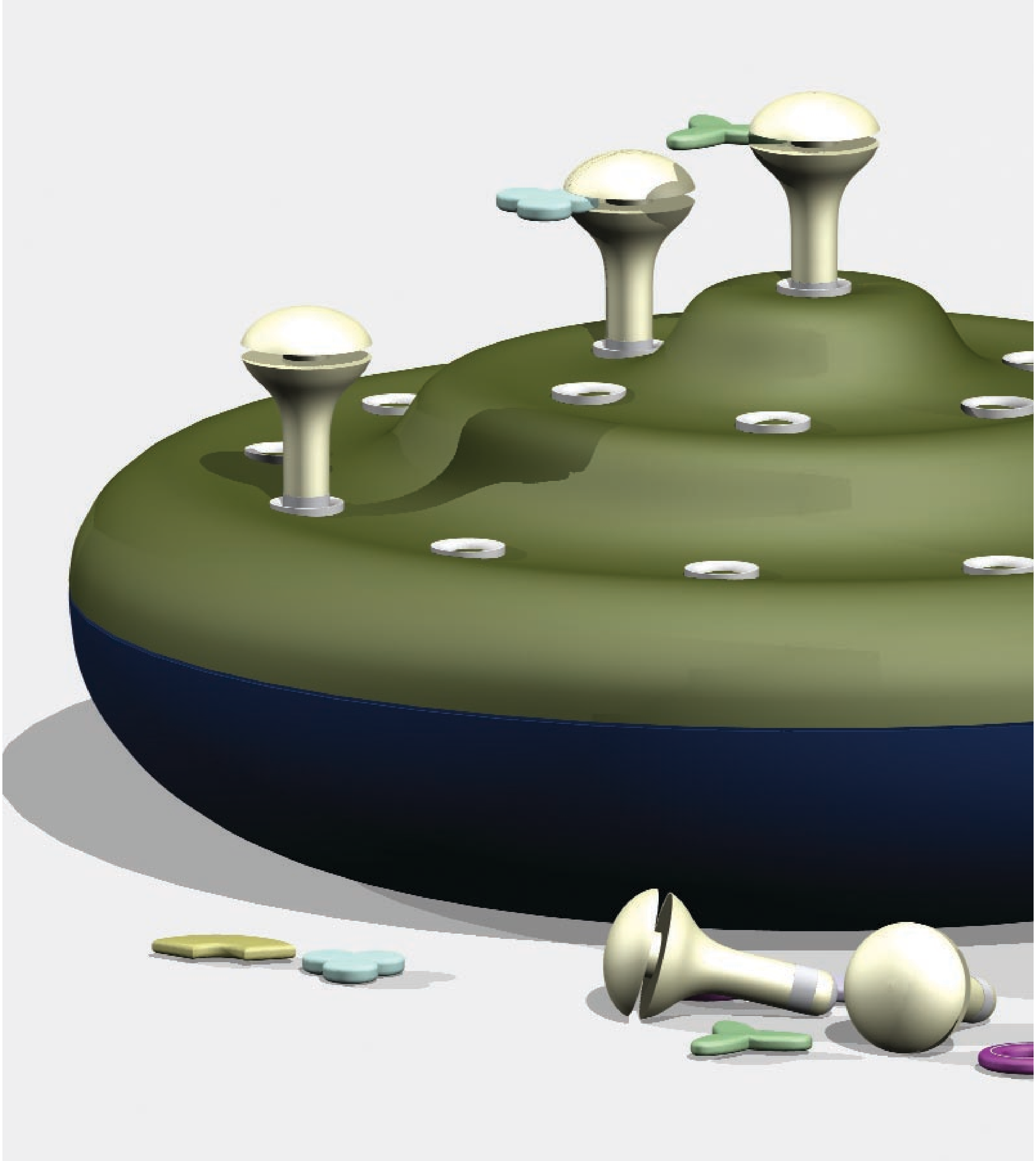
pic 20: singing ivy

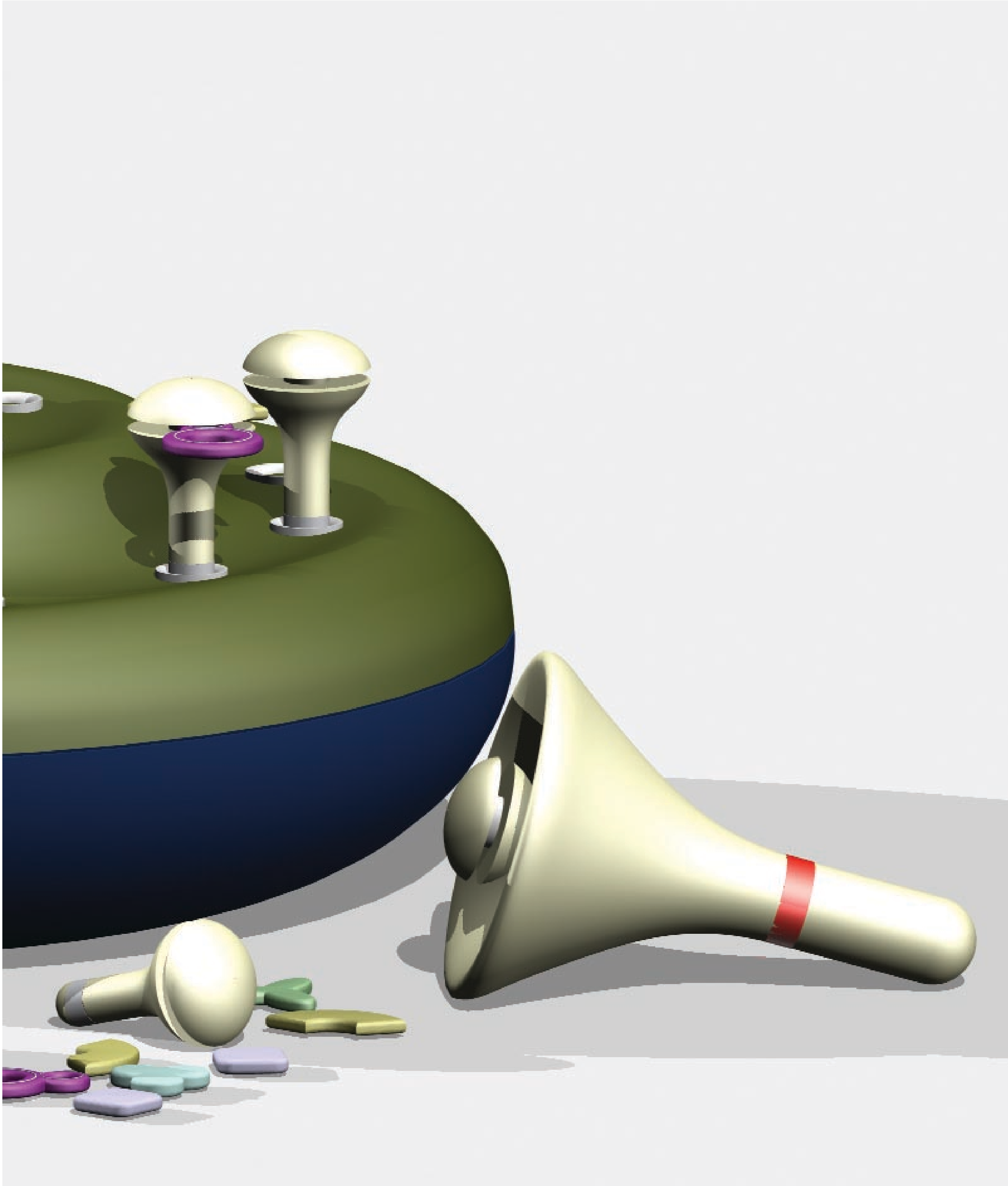


pic 21: echo cave

pic 22: rythm root

pic 23: final concept of SOUNDGARTEN





// CHAPTER FOUR

1 Presenting Soundgarten

SOUNDGARTEN enables children to create their own sound environment by manipulating physical toy objects. They can (a) use predefined sound samples, (b) record sound samples of their environment and (c) modify and arrange the different elements in sound scenarios, choose volume pitch and apply sound effects. The target audience is 4 to 6 year-olds, the recommended age for beginning a child's musical education.
Nevertheless, SOUNDGARTEN is also suitable for younger children from the age of 2-and-a-half years old. To reduce the complexity and for safety reasons it is necessary to exclude the smaller objects, i.e. the sound attributes. Older children could also benefit from the SOUNDGARTEN concept, as it is easily adaptable to more complex play and learning situations.

The final concept of SOUNDGARTEN consists of mushroom-formed items that represent sound samples. There are small flower- and leave-shaped attributes, which can be plugged onto the mushroom to modify the sound. A radio-wave microphone embedded in a shuffle-shaped device can record sound samples when a special recording mushroom is plugged into it. Last but not least, the flower-patch, i.e. the central part of SOUNDGARTEN, allows the sounds to be activated and arranged. The elements provide the following functions in detail:

1.1 The mushroom (pics 24-25)

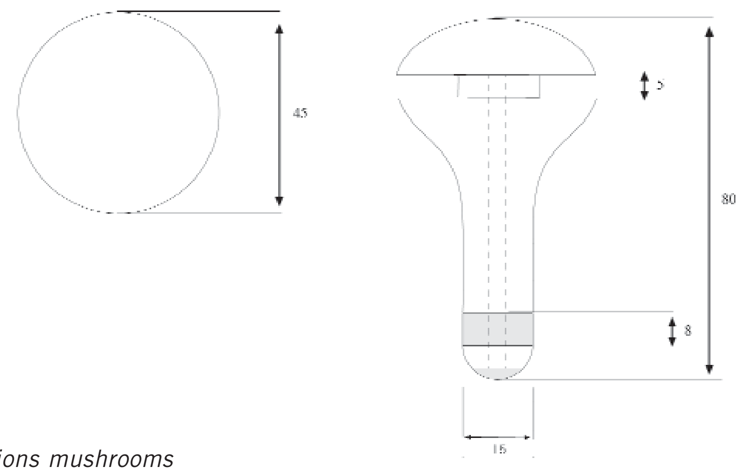
Within the SOUNDGARDEN system, the mushroom is the physical representation of sound. Each mushroom refers to a sound sample of up to one minute, relating either to predefined sound samples or to vacant space for sound to be captured by the child. The icon on their top can distinguish the predefined sound mushrooms and the recording mushroom. The same icon as the one on the recording mushroom can also be found on the „shuffle"-microphone. In addition, a strong colour contrast signalises the difference between the mushrooms.

The mushroom is 8 cm high with a diameter of 4,5 cm on the upper part. These measurements were selected based on the size of a child's hand. Three to four year old children can easily clasp the mushroom with one hand. Due to its shape (similar to that of an old-fashioned round porcelain door handle) it is likely that children would hold the mushroom at the head (upper part) rather than at the stem, which contains the electronic connection. The base of the stem has to be plugged into the holes on the flower patch in order to activate the mushroom.

1.2 The shuffle-recording tool

The shuffle *(pics 26-27)* symbolises the collecting tool. It mediates the idea that sound is a material that can be handled like any other material even though it can not be seen or touched. Keeping in mind that children tend to gather interesting graspable objects, the shuffle proved inviting to children of this age group and facilitated the idea of collecting sound samples. The device contains a wireless (radio-wave) microphone with a range of up to one kilometre. This makes it possible for children on their sound hunt to stroll around the garden, the house or nearby streets.

The shuffle records new sounds when it is connected to the recording-mushroom, i.e. when the mushroom is plugged into the shuffle. The combination of shuffle and *pic 24: mushrooms and filter attributes*



pic 25: dimensions mushrooms

mushroom is necessary to later impart control of the recorded sample on the flower patch by manipulating the reference object. The captured sample can be treated like any other sound object. The principle of how the shuffle functions is easy to understand: once the mushroom is plugged (Grafik) into the apparatus the recording action is triggered and stops when the mushroom is removed. From this moment on, the mushroom represents the captured sound.

1.3 The Flower patch (pic 28)

The „flower patch" is the central element of SOUNDGARTEN. It is the interface where gathered sounds are activated and arranged. It is the stage where the action takes place: the sound objects become the actors and the children the directors. The circular wave-shaped form contributes to the garden metaphor. The landscape offers a set of nineteen holes to plant mushrooms. Different topographical levels in the garden refer to different play back volumes (Grafik). On the lowest level the sound is silent, on the highest it is loudest, etc. Its size and its round shape enables at least four children to sit, kneel or lie on or around it and thus interact in their play. There is no cable or visible connection but rather a wireless local area network (WLAN) connecting flower patch and computer. The flower patch has a soft textile surface that is inviting. The inside of the flower patch is hollow providing storage space the toy elements when the children have finished playing. It can be opened and closed by means of a zipper.

1.4 The sound attributes (Bild)

The sound attributes are little flower- and leaf-shaped items that can be plugged into the mushrooms. They transform the sound quality of the sample. Each attribute represents a filter or sound effect. They can individually be combined (pic 37) and attached to any mushroom. Currently, SOUNDGARTEN offers 8 different filters and effects (Grafik):

// Attribute „backwards" (pic 29) plays the sound backwards, a rather amusing effect. One's own voice played backwards sounds very foreign.

// Attribute „echo" (pic 30): The echo item chan ges the imaginary location of the sound object, e.g. the dog suddenly barks on a mountain or inside a cave.

// Attribute „magic" (pic 31): The magic filter adds a special resonance field to the sound with the „magic" filter sounds can be enchanting.

// Attribute „high" (pic 32): Here the sound pitch is increased.
With this effect an adult horse becomes a baby horse ; a normal voice sounds like Micky Mouse.

// Attribute „low" (pic 33): Here the sound pitch is lowered.
„Low" turns the sound of a cat into a monster ; a violin becomes a cello.

// Attribute „slow" (pic 34): The sound is played back slowly.
With this attribute sound can be listened to in slow motion. It's a very efficient tool to discover tonal and rhythmic structures.

// Attribute „fast" (pic 35): The sound is played back at a relatively high speed.
This effect turns a slow car into a fast car, brings a slow horse to a gallop

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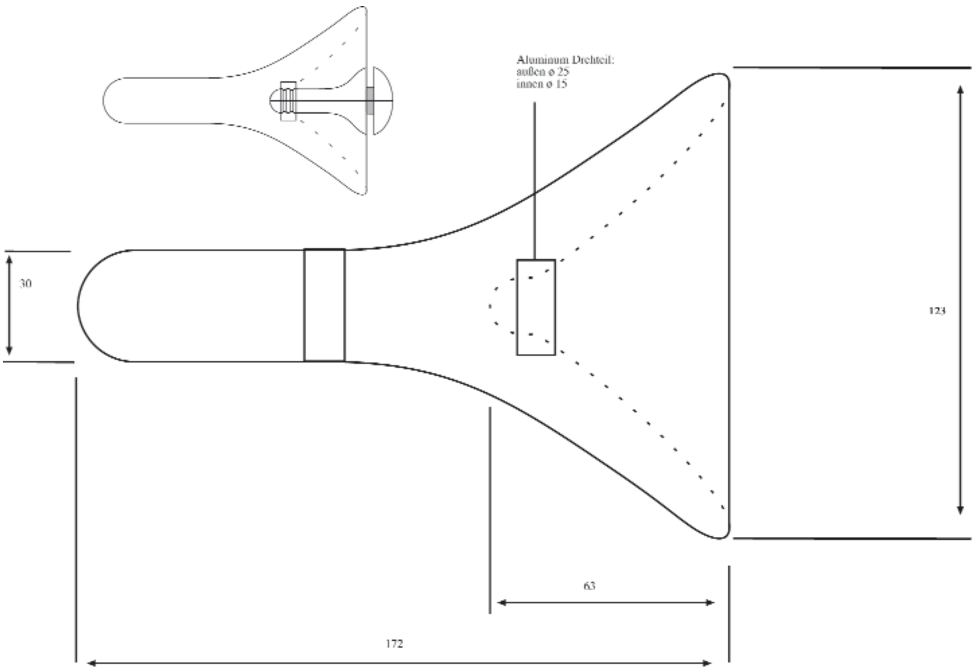
pic 26: shuffle



pic 27: shuffle dimensions

// Attribute „multi-voice“ (pic 36): The sound is played back on three tone levels at the same time. In applying this effect, a single flute becomes an ensemble; one singing bird sounds like three.

By the use of the sound attributes children can not only create their individual sound scenario, they can also learn about simple principles of order and form in music (e.g. high-low, fast-slow) as recommended by the German Federation of Music Education.

2 The predefined sound samples

The stored sound samples are divided into three groups: There are technical sounds (e.g. a car, a clock, a train), natural sounds (e.g. animals, wind, water) and musical instruments (e.g. a violin, drums, a horn). The various colours of the mushroom head indicate the different sections. The sound samples are not longer than one minute and are repeated on a sound loop. A pause of about 10 seconds between short sound events has been inserted so that short sounds and noises like the barking of a dog or a canon shot are not repeated monotonously. According to the specific application (see chapter „application“) the sound data banks can easily be selected and exchanged by parents or teachers via a graphical interface on the screen of a standard PC.

3 The Icons

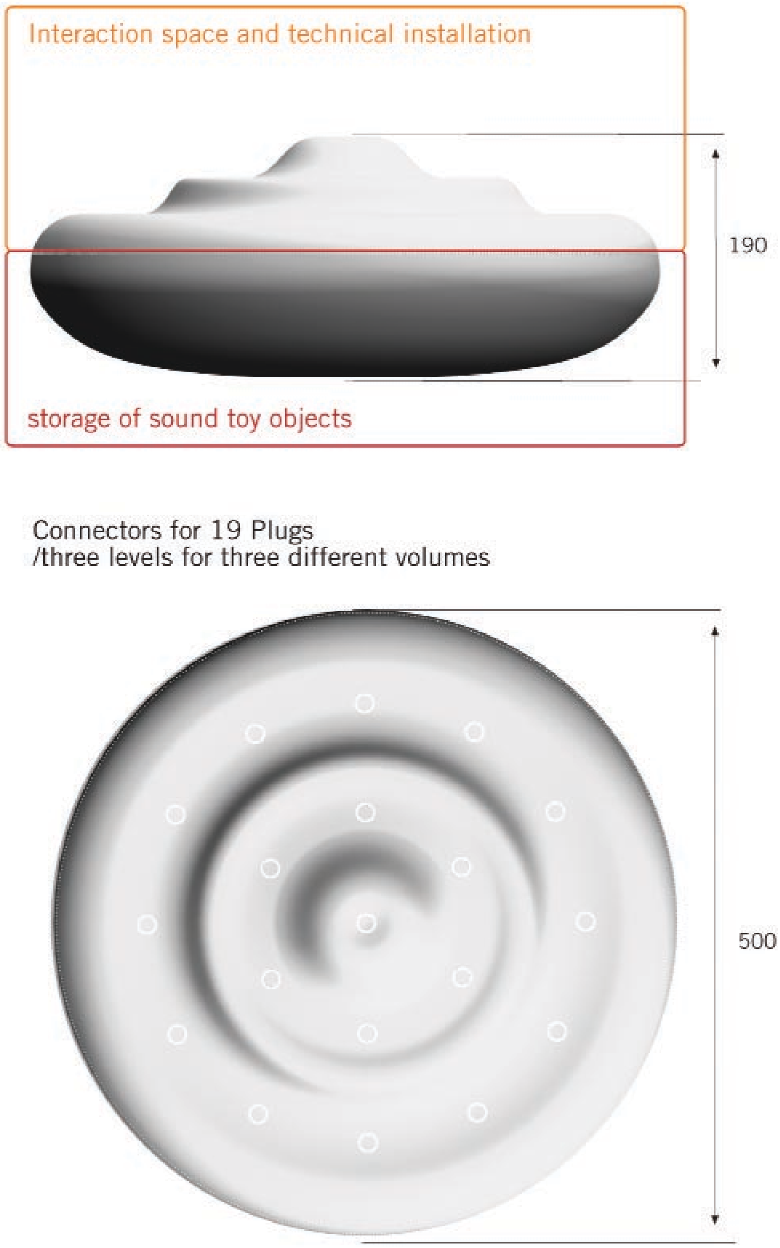
Icons on the top of each mushroom mark the different sound samples (pics 38-41). The symbols do not necessarily have to be identified on the spot, i.e. they don’t have to „speak for themselves“. Their function is fulfilled if the children relate the marked mushroom to a certain sound after hearing it. Manufactured with the *Nyloprint*-procedure, also known from stamps the icons offer a rubber-like relief-surface that is attractive in terms of tactile senses.

4 The technical concept

The SOUNDGARTEN interface works in combination with software that runs on any standard personal computer. Since PC’s are available in most households of the western world, SOUNDGARTEN does not provide a processor unit (CPU). In this way, the technical requirements of SOUNDGARTEN are reduced to a minimum, which reduces production costs. All the user has to do is to install the software and sound data banks on his or her computer and connect it to speakers. With a WLAN-connection the PC works completely detached from the interface itself and thus remains invisible to the user. Output-devices (speakers) don’t necessarily have to be seen and technical devices not a part of the interface are put aside. According to the concept of invisible and embedded computing, the user’s attention should be centred on the interaction space and not on the technical details (pic 42).

All technical procedures being activated by user interaction are primarily low voltage connections. Each element of the interface (mushrooms, attributes) is equipped with a different low voltage resistor. If an element is plugged onto the flower patch the system circuit recognises not only a change but the exact identity of the object and its attributes. This data is sent via WLAN to a serial port of the computer. These commands trigger off a software function that plays the required sound and applies the chosen effect.

The wireless microphone is probably the most expensive part of SOUNDGARTEN. This is why the recording device (shuffle) is deta-



pic 28: flower patch dimensions

SOUNDGARTEN1 18.06.2002 1:51 Uhr Seite 34

filter attributes

pic 29: „backwards“

pic 30: „echo“

pic 31: „magic“

pic 32: „high“

pic 33: „low“

pic 34: „slow“

pic 35: „fast“

pic 36: „multivoice“

pic 37: sound sample „horse“ with attributes „fast“, „echo“ and „backwards“

pic 38: examples for section „environment“

pic 39: examples for section „musical instruments“

pic 40: examples for section „nature“

pic 41: icon on „recording mushroom“

ched from the sound-representing object (mushroom). Considering that there should be a minimum of 20 mushrooms to record individual sound samples, the idea of providing a microphone for every recording mushroom was quickly rejected. The final solution is to have only one or two shuffles each containing a microphone and 20 or more recording mushrooms.

5 Material

The mushrooms and filters can be mass-produced with common enjection moulding procedures using poly propylene or other thermoplastics. The surfaces are then varnished with a product called Nextel. This two-component-varnish leaves an attractive haptical surface similar to that of an apricot skin.

The flower patch on the contrary should be made out of sandwich sheet material with poly urethane foam inside and fabric on the outside. This material is shape by thermocompression. There are several rucksacks, suitcases and other products on the market that are produced with this method. The effect is to have a semi-flexible structure with a textile surface. The flower patch should not be too hard either. A semi-flexible shell would be a lot more resistant to wear-and-tear.

6 Safety

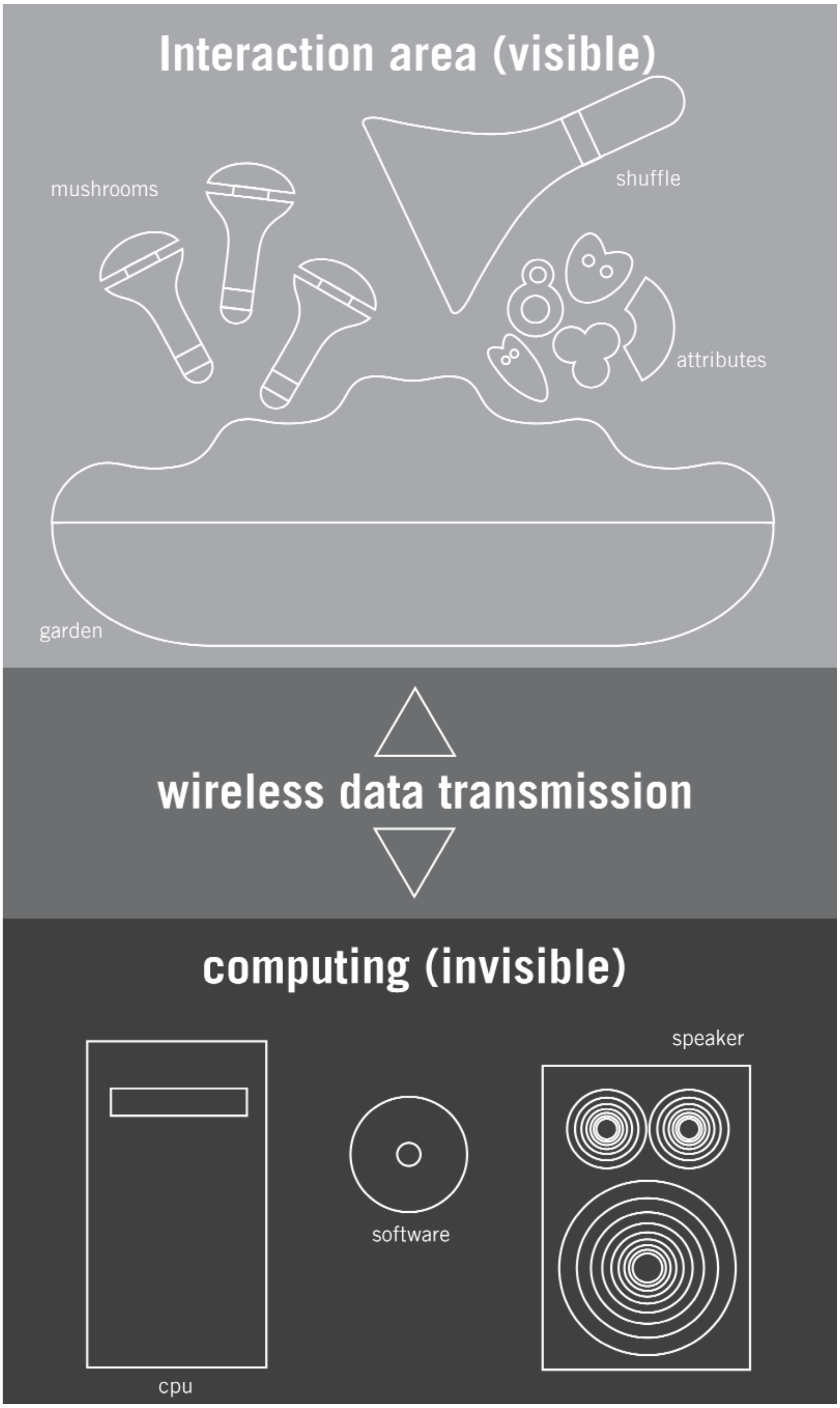
The product does conform to all the relevant safety regulations concerning products manufactured for children. SOUNDGARTEN is safe for children from the age of four. And as mentioned before, is also suitable for younger children, but care must be taken in removing the small sound attributes in this case.
Besides which smaller elements represent, the European Safety Standard for Toys (EN 71) warns about the danger of substances such as paint. It was therefore vital to ensure that the manufacturer of Nextel guaranties a non-toxic spit-resistant product. The minimal electric currents do not represent any danger what so ever.

7 Testing the product with children

Although it is very difficult to test a product without having a functional model to present to the intended user, testing the concept as it was with two small girls (aged three and seven) did help in analysing how children may react to SOUNDGARTEN. At this stage of the project only a first foam model, totally dysfunctional, served as a base for plugging the mushrooms into the holes on the flower patch but without sound. On the other hand I brought my laptop with a 2D-Application providing the function to drag and drop objects into a bowl and thus activating sounds.

The situation was precarious because I asked my girl friend to film and the children were a little bit uncomfortable by that. It was hardly possible to create a usual play situation. Still the meeting was very informative and therefore successful. Both children understood even without sound that the mushrooms are supposed to be plugged onto the flower patch. After giving a hint where the filter attributes could fit in, soon all mushrooms were decorated. Shortly the seven year old mentioned that this game was a little bit boring. The sound was missing.

The computer game gained more the attention of the older child. I was astonished how easily a seven year old could already handle a GUI. The principle of the game was quikkly understood and it was obviously fun for the older child. The three year old was less interested.



pic 42: technical principle

As a result of the testing I had the impression that the combination of the functions offered by the computer-application and the toy objects could be successful. Also I realized that a true conclusion could only be made with a full function model.

8 Applications

SOUNDGARTEN is a toy than can be used for many applications. On one hand children can use it autonomously exploring the possibilities and creating their sound environments. On the other hand teachers of EME classes in school and kindergarten can find multiple possibilities for well-targeted learning goals. Here are some examples according to learning goals:

8.1 Distinguishing, assorting and associating

Sound domino

Each child is asked to choose 5 or more mushrooms. One child starts the game by planting any mushroom onto the flower patch. Now the next child is invited to find a sound that is somehow related to the sound already heard. It can try out its mushrooms and choose one. Then it is discussed if the sound really suits to the last sound and why. Then the next child continues.

Setting a story to sound

Each child is given 5 selected mushrooms. The teacher reads or tells a story while the children are asked to set the story to sound. Also possible is this game the other way round: One child chooses some sound samples the others are asked to invent a story according to the sound.

8.2 Auditive perception and musical memory

What did you hear?

The teacher sets a sound scene on the flower patch by planting several mushrooms. The children face in another direction so they can only hear what's happening. Then the teacher takes the mushrooms away and asks the children to reproduce what they heard.

8.3 Understanding principles of sound and music

Constructing and deconstructing a complex piece of music

The software of SOUNDGARTEN offers teachers or parents the possibility of choosing a certain music piece. Each instrument of the piece is activated when the related mushroom is plugged. The exercise is to find out which instruments can best be used to recreate the music. For example, can a saw be used as an instrument? Step-by-step, the instruments are planted in the garden and everybody listens carefully what happens. Sooner or later the group might find out that two instruments, e.g. a violin and a bass, play the same melody. What else suits the tune? By trial and error and discussions the EME-class finally gets together the whole band or orchestra.

What is the original sound?

One child steps out of the group and chooses a mushroom and one or more filter attributes. The other children face another direction and are only allowed to listen. The child activates the modified sound. The others (a) have to guess what the original sound was and (b) what might have happened to the sound. Is it slower, higher than normal?

8.4 *Being aware of the sounds of the environment*

Sound hunt

Each child of the group is given a recording-mushroom. The shuffle (if there is only one) has to be shared. The teacher introduces a subject and the children are asked to find sounds in the house, garden, street that relate to this subject.

Where does the sound come from?

Two children are sent out to collect 5 to 10 sound samples. Having returned they plant the sounds and the others have to guess what they recorded.

9 Extensions

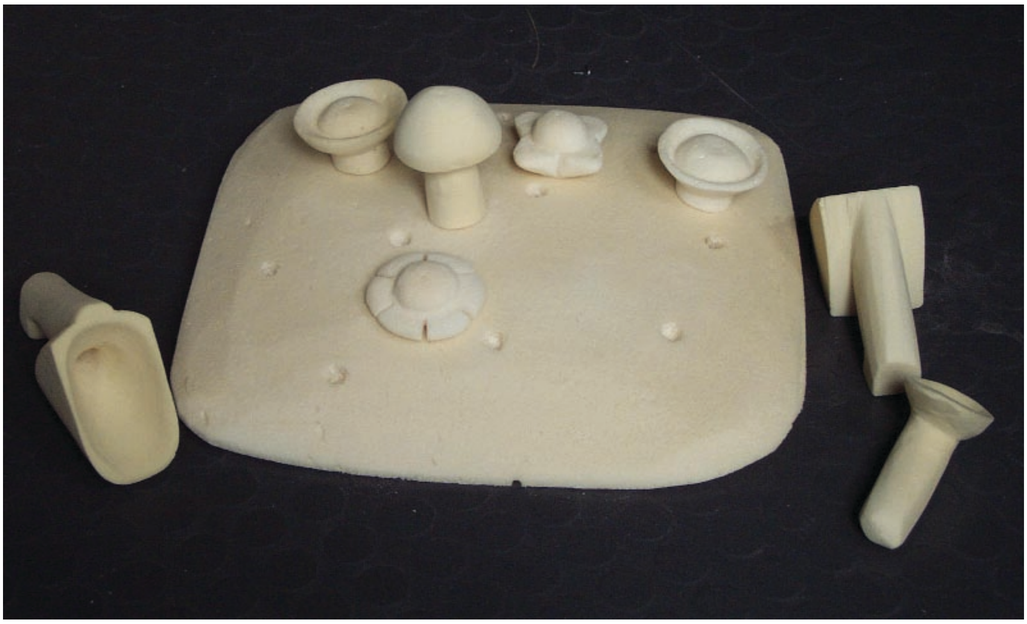
SOUNDGARTEN is extendable. Like Lego, Fisher Technique and other constructive toy systems SOUNDGARTEN provides an open system, which can be expanded indefinitely. Once equipped with the basic set (flower patch and shuffle) new filter attributes, mushrooms and sound data banks can be added. Depending on marketing strategies these extensions will be available piece by piece or by thematically specified sets. For example it can be imagined to offer 20 mushrooms and the necessary sound data (CD-ROM) in a pack with the subject „on the farm“ or „out of space“. (Grafik) Lego proves that this concept can work. Beside basic sets Lego offers complete scenarios (i.e. farm, wild west) or construction kits (i.e. cars, planes). One might assume that specific scenarios would inhibit a child’s fantasy. But the experience with Lego shows that very soon the parts used to construct a racing car are mixed with parts of the farm or space set in the very same washing powder box. Probably a racing car is more attractive to a child in modern times than a set of building blocks. But this shouldn’t be a problem: It is fine when the racing car can change into a house or anything else.

10 The making of Soundgarten

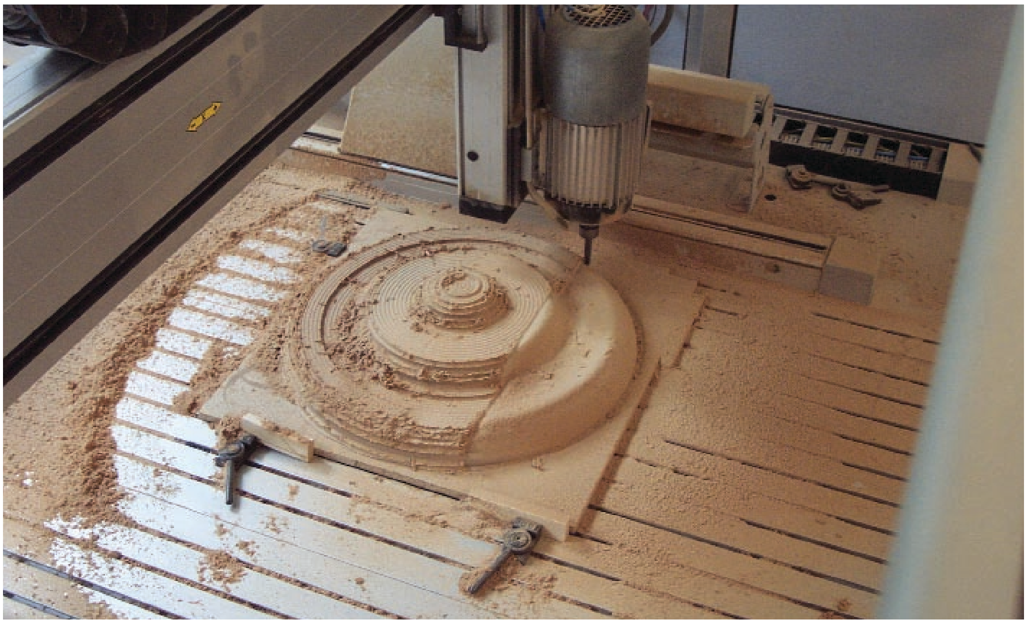
A big part of the conceptual and formal aesthetic development of SOUNDGARTEN took place during experimentation with form and material. Early 3D-sketches were quickly shaped with modelling foam. In the beginning the sound objects were still very figurative, e.g. they looked like flowers and mushrooms (pics 43-44).

Two or three models later the concept of addable filter attributes emerged. I painted the model in bright colours. Later I decided not to use the typical „children colours“, because I couldn’t find any prove to the statement that children prefer the primary colours red blue or yellow. The non-functional model was tested and discussed with children (see chapter „testing“). Besides it was the base for many discussions in terms of formal aesthetic tasks and technical development. *Yinlin Li*, an electronic engineer working at MARS-Lab encouraged me to build a function model straight away according to the simple technical solution (see chapter „technical concept“) he found to make SOUNDGARTEN functional within one-month time. The cheap and easy to make foam model was a perfect way to discuss the necessary installations that had to be made on the final model to implement the electronics. *Christoph Groenegress*, a computer scientist also working at MARS-Lab, was engaged in many discussions and finally took responsibilities for the software development. Li and Christoph received a detailed description of the functions of SOUNDGARTEN. At this state the development advanced simultaneously. While I was con-

pic 43+44: early models



pic 45, 46: milling cutter, models



structing the physical model in the workshops of the Department of Design in Cologne, Li and Christoph worked at MARS-Lab in St. Augustin.

The final shape of shuffle, mushroom and filter elements I specified with the 3D-Software „Form Z“. Only the flower patch I built once more in a smaller scale with modelling foam to be able to judge the proportions better (pic 46). Though the implementation of the electronics didn’t seem to be difficult it turned up to be a lot of work to provide the electronic contacts on flower patch and mushrooms. I didn’t want to use standard connectors like chinch or jack plugs. The SOUNDGARTEN-connectors had to be much easier to plug and had to have a less technical appearance.
After I figured out all the technical details I worked on technical drawings of each element. The mushrooms were quickly made on the turning lathe using highly compressed modelling foam. A drilling hole provided enough space to insert the resistor. More complicated was the making of the flower patch. It had to be hollow to leave space for electronics and installation. I built a positive form out of MDF (middle dense wood fibre) using CAD and a computer steered milling cutter. Then I applied heated 3mm poly sterol board onto the form. Later I coated the plastic form with lycra tissue to simulate the appearance of the textile-polyurethane sandwich material (see chapter „material“).

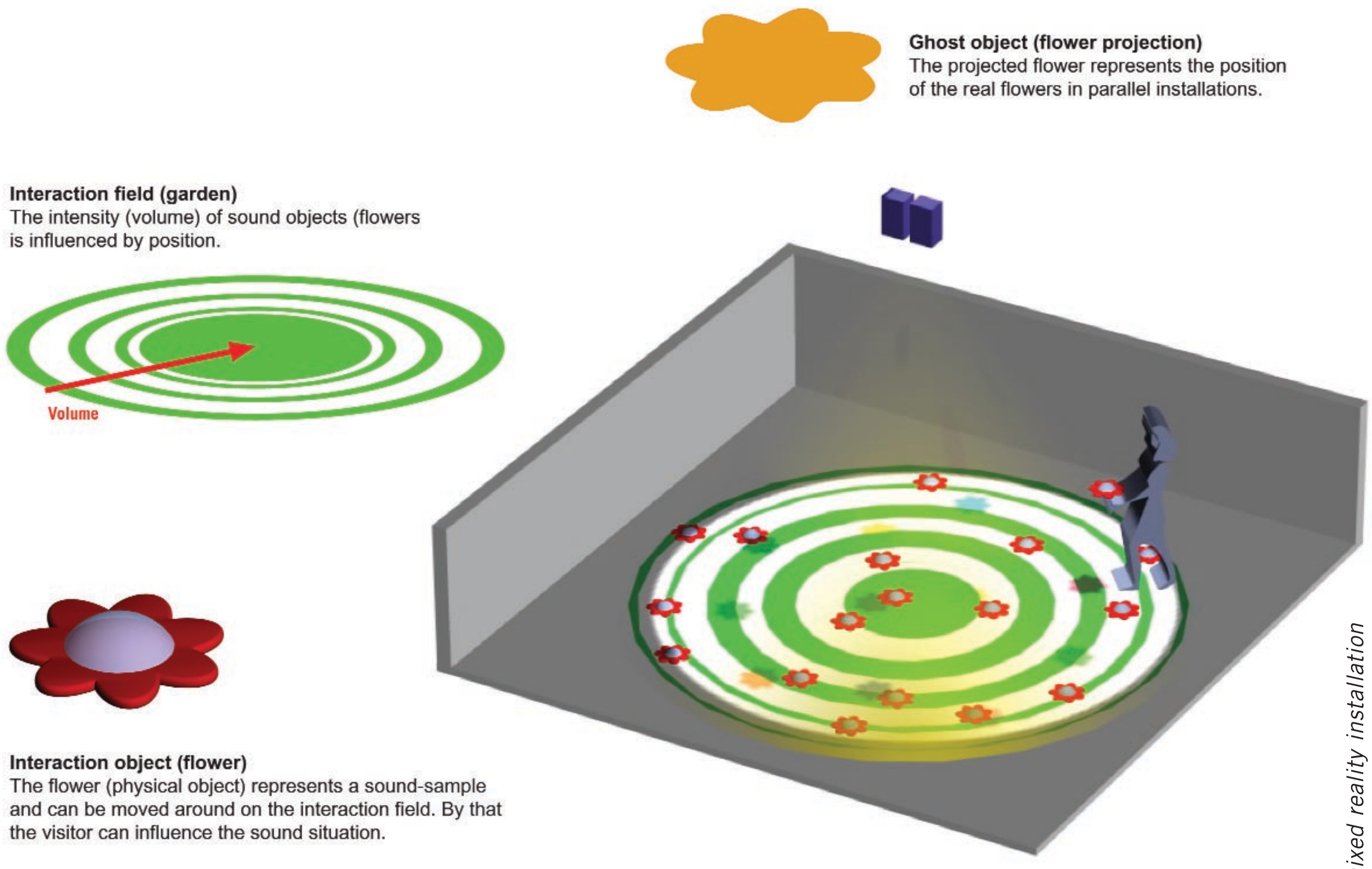
11 En passant

During the design process some good ideas had to be abandoned. Following are two interesting concepts:
One aspect shows a lot of potential but couldn’t fit into this project: network communication.
The screen application I designed to show the functions of SOUNDKÜCHE (see on CD // interactive model/ soundkueche) could be further developed regarding network interaction for children via sound. Possibly a website could offer a sound space where children in different locations collectively create their sound worlds or tell their stories using sound. Steven Spielberg once initiated a project for children in hospitals allowing them to communicate via Internet.

Another promising idea is the SOUNDGARTEN mixed reality installation (pic 47). The concept simply transfers the garden metaphor to a bigger scale. A room-sized installation of SOUNDGARTEN could provide flowers with the diameter of a plate or larger. Either these sound representing objects could be projections that can be moved by „real“ physical tools like a shuffle, or the flowers themselves are physical textile or plastic objects that are tracked by camera sensors. These concept ideas claim a more physical engagement of the user. Probably the most interesting approach is to combine projections and real objects. The projected flowers represent the contribution of users acting in simultaneous installation at other places. Many users in parallel installation could participate in an altogether telematic soundscape.

12 Conclusion

SOUNDGARTEN is an interface that offers children access to advanced electronic and digital technology that can help them to explore the world of sound. Regarding the learning goals of early musical education the functionality of SOUNDGARTEN provides a sound lab where children from the age of four can, independently or guided, record, manipulate and arrange sound samples.



pic 47: mixed reality installation

Compared to common graphical sound software interfaces, the principle of SOUNDGARTEN has the following advantages:

// It allows multi user activity.
// It doesn't require the ability to read.
// It records what it is doing (context awareness).
// It involves haptic-tactile senses and spatial reasoning, taking advantage of basic human skills.
// The recording device is part of the same „language“ and not a separate application.

Future work on SOUNDGARTEN requires product testing with children operating a full function model. Only then definite statements can be made. Letting children play and observing them will be a necessary step in the design process of SOUNDGARTEN.

To create a more human centred technology, it is necessary to find new approaches in Human-Computer-Interaction. The graphical user interface is not out-ranged yet but it is too one-sided to serve the multiple and complex tasks of today's computing opportunities. It is urgent to include other senses in interface development. For more than 10 years researchers at MIT, Xerox-Parc and Fraunhofer Institute have seen the need to turn from traditional GUI's and provoke radical changes in HCI.

SOUNDGARTEN is an experiment. One reason for the subject „toy“ was because there is more freedom in designing toys than in designing other application.

12 Literature

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