

# Hoppsa Universum – An interactive dance installation for children

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## ABSTRACT

It started with an idea to create an empty space in which you activated music and light as you moved around. In responding to the music and lighting you would activate more or different sounds and thereby communicate with the space through your body. This led to an artistic research project in which children's spontaneous movement was observed, a choreography made based on the children's movements and music written and recorded for the choreography. This music was then decomposed and choreographed into an empty space at Botkyrka konsthall creating an interactive dance installation. It was realized using an interactive sound and light system in which 5 video cameras were detecting the motion in the room connected to a 4-channel sound system and a set of 14 light modules. During five weeks people of all ages came to dance and move around in the installation. The installation attracted a wide range of people of all ages and the tentative evaluation indicates that it was very positively received and that it encouraged free movement in the intended way. Besides observing the activity in the installation interviews were made with schoolchildren age 7 who had participated in the installation.

## Keywords

Installation, dance, video recognition, children's movement, interactive multimedia

## 1. INTRODUCTION

Observations of children running around in big spaces, led to the idea of creating an open space that responded with sound and light to movement. The children's spontaneous movement with elements of repetition, theme and variation could be perceived as

a form of choreography. (could be called social choreography or play choreography) The present aim was to create an environment where visitors of all ages felt inspired to move with focus on one's own movement, space and sound, and other people's movement rather than on the understanding of the technology or the underlying system. The physical and emotional experience of being in the space, the awareness of self through exploration with body in space and music, all in a playful manner was in focus. These ideas of improvisation were inspired by co-author Sjöstedt Edelhölm's work regarding children's dance education and the use of improvisation in technical training [8]. An artistic research project, Hoppsa Universum was initiated for realizing these ideas by choreographer Anna Källblad at University College of Dance, Stockholm together with Modern Dance Theater, Stockholm.

Källblad's work deals with themes such as people's need for contact, their self-expression and what forms this takes. This has resulted in a series of works dealing with the roles of the performer and the audience, and how the shape of the performance space and the physical relationship between the performer and the audience affect the audience experience<sup>1</sup>. In "For Your Eyes Only", a dancer performed a dance live for one audience member at a time inside a closed box measuring 2x1m. The box was placed in various places such as theatre lobbies, hospital lobbies, nightclubs and art galleries. Källblad has been inspired by works by Susan Kozel and Gretchen Schiller for example "Trajets", in which large screens showing graphic images of moving bodies are controlled by the visitors' movements in the room.<sup>2</sup>

The idea of controlling music with gestures is not new. The DIST group in the University of Genova has investigated several ways of artistic interactions between gesture and sound. The analysis of general gesture parameters have been inspired by the theory by Rudolf Laban and the Japanese KANSEI research [3]. It has resulted in the Eyes Web system; a general-purpose graphical programming environment for extracting gesture analysis from

<sup>1</sup> [www.wipsthlm.se/sk\\_konstnarer.html](http://www.wipsthlm.se/sk_konstnarer.html)

<sup>2</sup> [www.incult.es/projectinfo.php?id=8&pi=2](http://www.incult.es/projectinfo.php?id=8&pi=2)

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video input [1] that has been used in several European research projects (e.g. [2]). There exists a multitude of other software aimed at real-time video analysis and manipulation (e.g. Troikatronix<sup>3</sup>, MAX/MSP/Jitter<sup>4</sup>). However, EyesWeb was designed primarily for analysis of expressive human gestures and was thus chosen for the present application.

Gesture control of audio with video recognition has been used in several applications at KTH. The first attempt was the Groove Machine in which a dancer controlled the mixing of different music loops using the emotional expression of the dance predicted by a combination of overall motion features extracted from a video camera. This evolved later into the computer game Ghost in the Cave centered on emotional expression of gestures and music [6]. It was played with two competitive teams, each with one to three main players. The main players had to express different emotions with either gestures or vocally that was then recognized by the computer utilizing fuzzy logic techniques [4]. An important feature was the collaborative aspects in the game. For example, the team controlled the speed of an avatar while the main player controlled the steering. The team also controlled the music – the more they were dancing the more intense became the music. The music was synchronized across the teams. One of the teams controlled the percussion instruments and the other team all the other instruments.

In the recent artistic research project “Nu Moove” led by Lisa Ladberg, Royal College of Music, Stockholm, gesture control of sounds was used in a stage production. Two professional dancers controlled an interactive sound synthesis using both overall motion parameters and different zones on the stage.

Siegel and Jacobsen [7] describe an example of an interactive dance application, which has many ideas in common with the present study. Instead of having non-invasive video cameras they used custom-built bending sensors attached to the joints of a professional dancer. The bending data was transferred wirelessly to a computer and mapped to sound-generating software. Several scenes were defined using different mappings and sound material. They also discussed the interesting shift of the roles of the composer and dancer. When the dancer is controlling the music there is a shift from being a dancer to becoming a musician. This new role of using gestures to control the sound may come in conflict with the visual impression of the gesture; the latter obviously being the modus operandi of a dancer.

The dancers’ role in the interaction between choreographer and dancers has changed considerably recently. The dancer’s role has undergone a change from interpreting the choreographer’s intentions and movements to being actively participating in the creative process by also providing more of the movements, that is, going from interpreters to creators. In the current project this has been taken one step further in that there is no determined choreography and the audience becomes performers themselves taking an active part in the result.

## 2. METHOD

### *Children’s Moving Session*

The development of the installation was the last stage in a three-step process that started with observation of children’s’ free movement. Twelve groups of children age 3-6, with 7-9 children

in each group (age divided) were let into an empty dance studio (without mirrors) measuring 150 m<sup>2</sup>. Each session was filmed from a fixed video camera. The instruction was “Welcome in, we will start in a while”. The children who all knew each other coming from the same preschool group, immediately started to move around in the space. After approx. 5 minutes (depending on the activity in the room) music was put on. Music of different styles (orchestral, pop songs) with different rhythm and tempo was played for each group. The music was played for 10-15 minutes, after which the children were gathered in a circle to rest and to discuss what had happened. The children were asked if they remembered how they had moved. The same music was played again. The children then repeated some of the movements and made new ones. During the second phase of moving around 2-3 children at a time were invited to a 5 minute recorded interview. Accompanied by the interviewer they left the room, followed blue arrows taped on the floor in the outside corridor to another room close by. After the interview they returned to the dance studio and joined in the ongoing activity. Summarizing these interviews, most of the children experienced the session in the dance studio as positive. No one expressed negative feelings with the exception of a few responses referring to a particular music example and the dark studio being scary. (Two groups came a second time and spent the session in a black dance studio instead with purposely little lighting and using flashlights. The idea was to observe if a near to dark room affected the amount of movement activity. It turned out that it influenced the movement very little.) In these interviews to the question what is your favorite type of movement the answer most often was running.

### *Choreographic Processing With Dancers*

In the second step, based on an analysis of what happened in the sessions with the children; through looking at shapes, effort and timing of movement; balance and shift of weight of the body; overall movement patterns, interaction, and moods; a 23 minutes dance was choreographed. This was done in collaboration with five professional contemporary dancers. The dancers began by learning some of the children’s movement in detail. In this process something that stood out compared to other choreographic processes was a relationship to time, interaction and perception of self. In the children’s movement there was no expression of anticipation, planning, or judging. The adult dancers tried to move with the same intent and found this very difficult. When trying to do the children’s material they became aware of their own habits of for example anticipation, or judging. Trying to move without these learned habits became one of the main focuses in the work and affected it on all levels regarding, space, shape, timing, emotional expression, the way scenes were structured, overall dramaturgy, and relationships between the characters/dancers and the audience. When looking at the movement and working with it we found an emotional content that we tried to put into the choreography and its performance. This came to play an important role in the choreography and therefore also in the music based on the choreography. An example of these types of gestures can be seen in Figure 1.

### *Composing Music*

In the third step music was composed for the choreography based on a live dance performance and on a video recording of the choreography by the composer Niko Röhlcke. He analyzed the choreography and made a chart of it according to a timeline marking for example rhythmical and spatial patterns and themes. He also worked with tempos and efforts set by the dancing,

<sup>3</sup> [www.troikatronix.com](http://www.troikatronix.com)

<sup>4</sup> [www.cycling74.com](http://www.cycling74.com)

images that the different sections evoked and specific movements in the choreography. The finished music contained six sections of clearly different character.



**Figure 1.** An example taken from the dance performance with the dancers interpreting children's movements.

#### *Choreography Of Music*

In the fourth step the actual music material of the installation was obtained by decomposing the music based on the sections and within a section according to its relationship to where in space and time movement and music had coexisted in the choreography. The different sounds were in this way "choreographed" into the room. The interaction was tested in advance in a dance studio with four cameras temporarily placed in the ceiling using tripods. The aim was to create a sound environment that invited and encouraged movement throughout the whole space in different ways in different musical sections.

Although basing the decomposing of the music on the choreography it was more important that each scene worked in its own, was musically interesting and that it inspired to movement than for the sound response to stay true to, for example, exact patterns in the choreography according to the original musical score. In each step of the process artistic choices were made in order to keep with the feeling of what the artist wished for the installation to express.

### 3. TECHNICAL DESCRIPTION

The final system was realized in the Botkyrka art exhibition hall situated in Tumba outside Stockholm, see Figure 2. In the exhibition hall, a room with the size 130 m<sup>2</sup> (10x13m) was constructed using moveable walls. The aim was to use the whole floor as the active space for controlling the music. This was realized by using four video cameras mounted in the ceiling about 4 m above the floor pointed downwards. Variable zoom lenses on the cameras were adjusted so that each camera covered one fourth of the floor area. In order to be as much as possible independent of the lighting, we used video cameras for night surveillance equipped with an infrared light ring (KPC-N600) and with an additional filter that removed visible light. In this way it was possible to use dynamically changing light without interfering with the movement detection provided that that light change was not too fast.

The purpose of the light design was to stimulate movement, hint the functionality of the installation, emphasize the difference between the scenes - making the changes obvious, and to create a visual atmosphere corresponding to - and working together with - the music and the sound effects.

Even though the installation was temporary, we wanted the equipment to look as it was integrated into the room. By removing distractions we wanted to help the participants to focus on their own bodies in the interaction with the music and the light. As the exhibition hall could never meet the weight and power requirements of a full light rig we had to find a flexible, light and low power solution. Therefore we chose fluorescent light modules from the manufacturer Leader Light. Each module is fitted with four tubes in the color red, green, blue and white. There is full color blending, a very bright output with very low power usage and a reasonable weight. Fourteen modules divided in two parallel rows were neatly fitted into gaps in the acoustic padding in the ceiling, covering the room's entire length. The light installation was programmed and controlled through an AVAB Pronto! ver. 3.1 DMX light console.

A speaker was placed in each of the four corners. All the equipment were connected to one PC computer running Windows XP equipped with a sound card (E-MU 0404) and two analog video capture boards (IEI, IVC-200).



**Figure 2.** A picture of the installation showing two of the cameras and two of the loudspeakers.

The sequences and different scenes were pre-programmed in the light console. The overall control including change of scene and interactive control from the motion was controlled from the computer using the MIDI protocol.

The motion analysis of the video cameras was done in the EyesWeb program version 3.3.0 [1]. Each camera zone (covering one fourth of the floor) was subdivided into four regions resulting in 16 different active zones covering the floor area. These zones were mapped differently to the music and light in each scene. The analysis of the motion was rather simple and consisted of computing the overall quantity of motion (QoM) for each camera and each sub zone (see also [5]). Briefly, this was computed by taking the difference between consecutive frames of the black and white video input, applying a threshold and counting the number of white pixels. This number is the resulting QoM measure and will reflect the amount of total movement within the camera view (or sub zone). In addition, the frame difference was also computed for the inverted input video signal. By using this double detection the number of changing pixels for a given gesture will approximately be twice as much since both sides of the body contour are detected. Thus it considerably improves the detection

accuracy. The resulting output from the video analysis is a stream of numbers reflecting the amount of motion in each zone.

A patch written in pure-data (pd)<sup>5</sup> served as the overall control unit. The complete sequence consisted of six different scenes controlled by a timer unit. Each scene was active for a fixed time duration and the whole sequence took about 20 min to cycle through and was then repeated. All the audio control was done within the pd patch. There was a separate sub patch for each scene containing the audio samples and the specific control in each scene. All audio samples were panned in four channels and positioned according to their trigger position in the room facilitating for the user to understand the interaction.

A large floor map showing the correlation between movement and sound response in the different scenes, was at display outside the exhibition space and was used to explain to the visitors how the interaction worked. The idea of having the map on the floor was to better couple the explanation with the installation and to encourage the visitors of physical action while comprehending the functionality of the system. Following is a description of each scene and its interaction.

#### *Scene 1 Disco*

The tracks in the original sound track were divided into four main parts coupled to the four cameras. The music was groove-oriented with two different percussion parts, each divided in two levels, one bass part and one part with the rest of the melodic lines and the accompaniment. The interaction can be seen as an advanced mixer in which the music is continuously playing and with the volume of the different tracks controlled by the QoM from each camera. Thus, when nobody is moving the room it is silent. Moving in one zone will activate the corresponding track. The amount of motion controls the volume but will also activate new tracks in order to enhance the coupling between motion and sound. Thus to “play” the whole music there must be several people moving. Scene 1 was optimized so that the typical children movement of running around the room in a big circle would maximize the music output.

The basic light was dim blue with just a tint of red. When movement occurred in one of the zones the blue light started to move in a smooth chase clockwise around the room. If two zones were activated simultaneously a red chase was added. Though, just as smooth the red chase was slightly faster allowing every nuance of color between blue, purple and red to run through the room. Activating a third zone made the intensity of the blue chase reach maximum and adding a movement in the forth zone made the red chase peak as well.

The main idea was that the running light would stimulate the participants to run. In practice if a few people were running around very fast they could activate all four zones, thus getting the entire soundtrack as well as the full light.

#### *Scene 2 Chinese percussion*

In this scene different traditional Chinese instruments could be played. There were several different percussion sounds as well as bowed and plucked instruments. All the 16 zones were used for triggering individual instrument samples. They were divided into different instrument groups such as percussive sounds and string sounds. The sound started if the QoM was reaching a fixed threshold. The volume was controlled by the amount of QoM.

The light started with an instant bright all covering green light, sharply contrasting the purple color of the previous scene. This light quickly faded to the basic dim light of the scene. We worked exclusively with the green color in this scene. Each of the sixteen zones were connected to the closest corresponding light. As the participants played the different instruments, they were at the same time playing the light. In this way the light hinted the different camera zones giving the participants a visual reference to where a particular sound was played.

#### *Scene 3 Waltz*

Similar to scene 1 the tracks of the original music were divided in different groups. However, the control was slightly different. The melody track was activated if there were movement anywhere in the room. Thus one person could walk around in the whole room and play the melody. When there was movement in two zones simultaneously, also different effect type of sounds were activated. When there was movement in at least three major zones the rhythmic accompaniment was finally activated.

In scene three we worked with a pale yellow color base. When a zone was activated, as the music faded up, the pale yellow light dimmed slightly and gave way for a soft red pulse. This change only occurred in the activated zone. The idea was to stimulate movement in one zone at a time. With participants in all four zones the entire room became warmer and more suitable for a soothing waltz.

#### *Scene 4 Lightning*

The major interaction was the possibility to exchange “lightning” pulses from one side to the other. A large movement in one corner activated these. There was a resulting light rapidly moving to the other side and a corresponding sound moving in the same direction. This pulse could not be retriggered before it has been “sent” back from the other side. In addition, movement in the outer areas activated some background sounds. The light base was space blue. Using the white fluorescents in one row successively created the lighting pulse.

#### *Scene 5 Techno/metal*

Similar to scene 1 and 3 the music was divided in tracks. The major groove was activated if everybody was gathered in the middle of the room and was dancing forcefully. Some effect sounds were triggered in the corners of the room.

The green and blue lights corresponding to the activation zones in the middle was dimly lit from the start. When the first of these zones were activated the green lights started to strobe to the beat of the music. Upon adding activity in the second and third zone the blue and white fluorescents started to strobe as well. Activating the outer corner zones sent red light running back and forth through the entire length of the room.

#### *Scene 6 Dawn*

Here the light was sequenced simulating a dawn with gradually increasing light and changing colors. The only way to make sound was to move on the floor of the room as detected by the fifth video camera mounted in a corner. When everybody was creeping on the floor a bird singing sound emerged followed by a drone sound. Scene six started completely dark. All the lights were then randomly turned on with the lowest possible intensity and then slowly faded up over a period of three minutes leaving the room very brightly lit in the end.

<sup>5</sup> puredata.info

#### 4. EVALUATION

The exhibition was open to the public during a five-week period. Schools could book for a guided tour of the installation and a workshop. During public open hours there were personnel available to answer questions and to offer a guide to the installation. The installation came to attract people of all ages from preschool to senior citizens. All available school tours were fully booked and there were in total about 3980 visitors. Interviews were made with 25 children age 7 two weeks after they had visited the installation. Summarizing their answers the children all thought it was a fun, exciting and magical experience. They were fascinated by fact that sounds were invisible. They could not see any instruments, and they were impressed that one could not see where the sound came from. They felt great freedom to dance and to move around freely without instructions from any adult. This was an indication that the intended purpose with the installation worked with the children. It was also informally confirmed while observing the visitors in activity in the installation.

Following are some representative quotes from the interviews:

Q: What did you think when you heard the music?

A: I thought it was fun and that you could dance how you wanted and you didn't need to decide, as it usually is.

A: Different things, perhaps that it was fun.

A: I thought when there was lightning, and then I was just playing and having fun. It was a bit strange because they were transparent; I mean invisible instruments in that room.

A: I thought it was very well done because I would never dream about making such invisible instrument in the rooms. It was like magic. The lightning, it was like you only did like that with the hand in the air. That was very cool.

A: It was exciting

Q: What was exciting?

A: That the music started without you knowing it. It changed.

Q: Why did you want to move to that music in that room?

A: It felt so good to be able to move when the music was on.

A: It's fun, instead of standing still. It is more fun to dance.

A: It's more fun to move than to stand still.

A: It was so, it was like it steered me. It was so fun I felt I had to move.

A: They (the instruments) almost steered me. It felt a little weird sometimes you could do it but you could not. (Shows a movement)

Q: You could not?

A: I wanted to do it then it steered so I started running instead.

Q: How did it feel to move in that room?

A: Good!

A: It was fun. To be with friends and play with them at the same time you are dancing.

A: It was fun with my friends.

A: It was a lot of fun.

Q: Why was it fun?

A: It was just like that with different music and dances and different light and everything was sort of higgledy-piggledy.

Following are some comments from the staff at the exhibition hall to the question "What have you seen children and adults do?"

Children were open and unafraid; grown-ups asked what one should do. The children were more spontaneous and wild. I told them to go in, to try it a little and to come back. I tried to get them to discover new movement patterns. Many people were looking for an answer/key in order to interpret it in the

right way. Adults with little children were more relaxed. Older people were both shy and let go. Many of them brought their grandchildren. 9-13 year-olds who hangs out in the nearby shopping center found "Hoppsa" where they run around a played for a while.

Many old people came, some from the elderly home, and groups from schools for people with special needs. These groups spontaneously saw a room that gave energy enabling them to walk around. They were sometimes hesitant at first, standing in a corner. High school kids went mad and the teachers backed and there became groups within the groups. The "cool guy" was actively participating but also the shy ones dared also.

#### 5. DISCUSSION

The idea of the project was, both in process of making it and in the final installation, to be very open to input from those who participated and to allow for them to shape the project. Making room in the process and in the final "product" for shared ideas and working material (movements, music) contributed greatly to the project and gave it lots of energy and momentum in moving forward. In this process with its different steps, how something was done, to great extent also shaped what was done.

Something can be said about usefulness, purpose together with openness. The aim was to offer a room that had possibilities to become different things depending on how one moved in it. So one could see it as a place where the participant used the room for her or his needs, and at the same time through her or his dancing expressed this in a sort of performance. This could thus be seen a "product" that consists of an empty room, no light, no sound, until someone steps in, and shapes it according to her or his needs or pleasures. This also touches on ideas such as does the visitor become a dancer? Does the dancer become a musician or does the music become a dance or a choreography? From our experience from the installation, professional dancers tended to see it as a dance improvisation focusing on the physical and emotional experience in interaction with music and light. Musicians, on the other hand, tended to see it as musical instruments controlled by gestures. Either way it is through their bodies in motion that they interact with the room.

When meeting with dance and art teachers who were to receive school groups in the installation a discussion came up to what extent the visitors/participants should be given instructions. The teachers had planned for a workshop in and around the installation that included painting and making a performance. The choreographer wanted for the visitors to have the freedom to do what they felt like in the installation. Depending on one's background one had different preferences of how to use the installation. This relates to the possibility of the shaping of the "product" or experience. How one uses it affects what one gets, in this case the children's experience of being in the space.

It is popular from elementary to high school education to use art and dance for learning about other things for example communications skills, discipline, conflict solving, physical exercise, mathematics and history<sup>6</sup>. We argue that it is also very important to practice art as art in order to understand it and its processes and techniques, including creativity, to fully make use of it in all those other areas mentioned above. From the interviews with the 7 year olds who had visited the installation one can see

<sup>6</sup> [http://www.oru.se/templates/oruExtNormal\\_\\_\\_37079.aspx](http://www.oru.se/templates/oruExtNormal___37079.aspx)

that they had strong memories and impressions. The opportunities they were given to explore and make decisions themselves played an essential part in their experience and memory of it.

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