SPATIAL SOUNDS (100dB at 100km/h)

by Marnix de Nijs and Edwin van der Heide.

Spatial Sounds (100dB at 100km/h) is an interactive audio installation by Marnix de Nijs and Edwin van der Heide. In this engine-powered installation, a speaker is mounted onto a rotating arm that is several meters long. Like a watchdog, the machine scans the surrounding space for visitors. Closer investigation would be tempting fate, with the rotating arm swinging so powerfully round. You hear the impressive sound of the mighty motor revving up, turning faster and faster. You can feel the displacement of air as the speaker whizzes past you, and you had better step back, out of reach. The machine slows down and, when the shock wears off, you start exploring the space, with your movements manipulating the sound it produces. Just don't get too close! Spatial Sounds (100dB at 100km/h) builds up a physically tangible relationship with the visitor, since it is the game of attracting and repelling between machine and visitor that determines its sound and movement.

The Installation:

Spatial Sounds (100dB at 100km/h) is an installation which excists out of a speaker on a long arm with a counter weight on the other end. The arm is able to spin. It's controllable from a very slow to a very high speed. The maximum speed of the speaker is 100 km/h. A high speed distance measuring sensor is mounted close to the speaker and is measuring from the arm into the space. The sensor is scanning the objects and the audience in the space. Because it is spinning it is creating a spatial describtion of the space. The result is a continiously dynamically changing map of the space quite similar to a traditional radar map.

Spatial Sounds (100dB at 100km/h) is an interactive installation. It is an installation with a very strong intelligent behaviour. The arm is not simply spinning slow or fast but can make very distinct movements in both directions. On one hand the Spatial Sounds (100dB at 100km/h) lives a live on itself on the other hand it is reacting very direct to the people in the space. With the sensor it is possible to detect how close the visitors are and where they are arround the arm. The installation lives a live of itself as it is scanning the space. It's making inspecting movements and it will be generating sounds which symbolize the scanning of the space. It is generating infinitly short but loud pulses and is 'listening' to the reflections of the empty space. It will be a composition of pulses in different frequency ranges and in different ritmical patterns. When people enter the room they are immediately detected. The installation will react in both a musical and in a gestural way. On one hand the sounds are directly related to the position of the arm. On the other hand the sounds are related to the dynamic 'map' of the space and the audience. The sounds are very physical. For example when the speaker is pointing onto somebody it will generate a specific sound. This also works on a high speed and with multiple people in the room. Otherwise the sounds and movements of the arm tempt people to move through the space. Different locations in the space can represent different sounds so does the distance of the people to the rotating arm.

Technics:

The sound and movements of Spatial Sounds (100dB at 100km/h) are generated in realtime. The algorithms for generating the sound and movement are defined very precisely but what really sounds depends very much on what the visitors do with the installation. On top of the speaker there is a sonar sensor which is measuring the distance of visitors and objects to the speaker. The sensor is measuring in a beam facing from the speaker. Also there is an angle sensor mounted on the axis of the installation. The data of both sensors is send to a computer which is generating the sound. When the installation is placed in a room it first learns the shape of the room without people. This way it can distinguish the people in the space and the space itself. After this process the computer is able to recognize the different visitors in the space. Spatial Sounds (100dB at 100km/h) has different ways of reacting to the visitors. It can react with movement and/or sound on individual people and it can react on general behaviour of people. Besides reacting on the visitors the sound is also directly related to acceleration of the arm and shape of the room arround the arm.

The interaction of Spatial Sounds

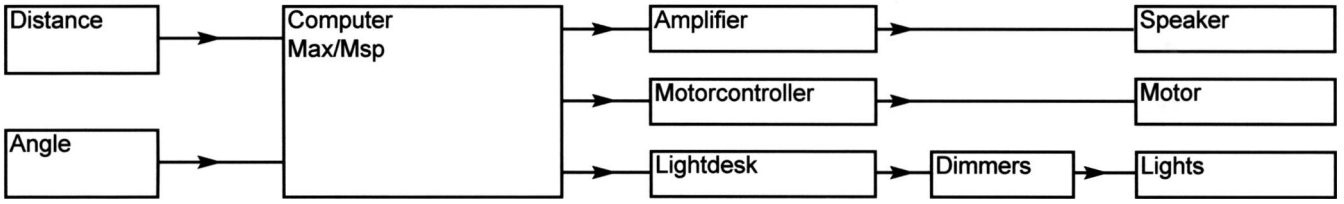
Spatial Sounds is a purely interactive installation. It's constantly scanning the space for visitors to communicate with. This document first explains the technical setup and afterwards explains the content of the interaction

The setup

Spatial Sounds contains two sensors:
- One Polaroid ultrasonic distance measurement sensor with self developed software and hardware based on a microcontroller. It generates midi output. The sensor is mounted on top of the speaker. It measures the distance of objects in front of the speaker up to 7 meters.
- One bifase angle measurement sensor with self developed software and hardware based on a microcontroller. It generates midi output. The sensor is mounted on the bottom of the axis. It outputs the current position of the arm in steps of 3 degrees.

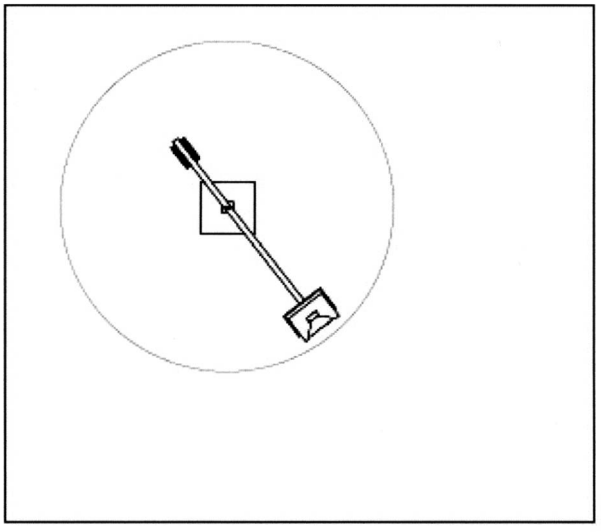
Then:

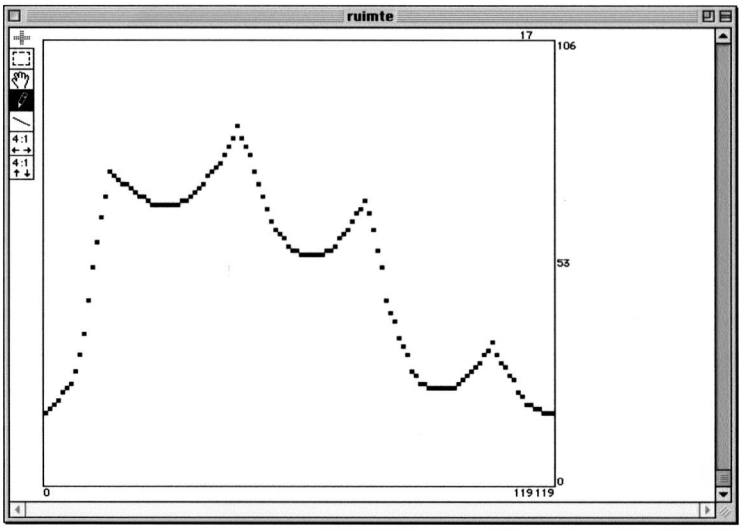
- The information of the sensors is communicated via midi to a Macintosh computer.
- The computer is running self developed interaction software created within MAX/MSP
- The software is generating the sound in real-time
- The software is controlling a trifase motorcontroller via a midi to voltage converter
- The motorcontroller controls the speed and the direction of the motor
- The software is controlling a lightdesk to change the light settings and incidentally switch on a stroboscope.



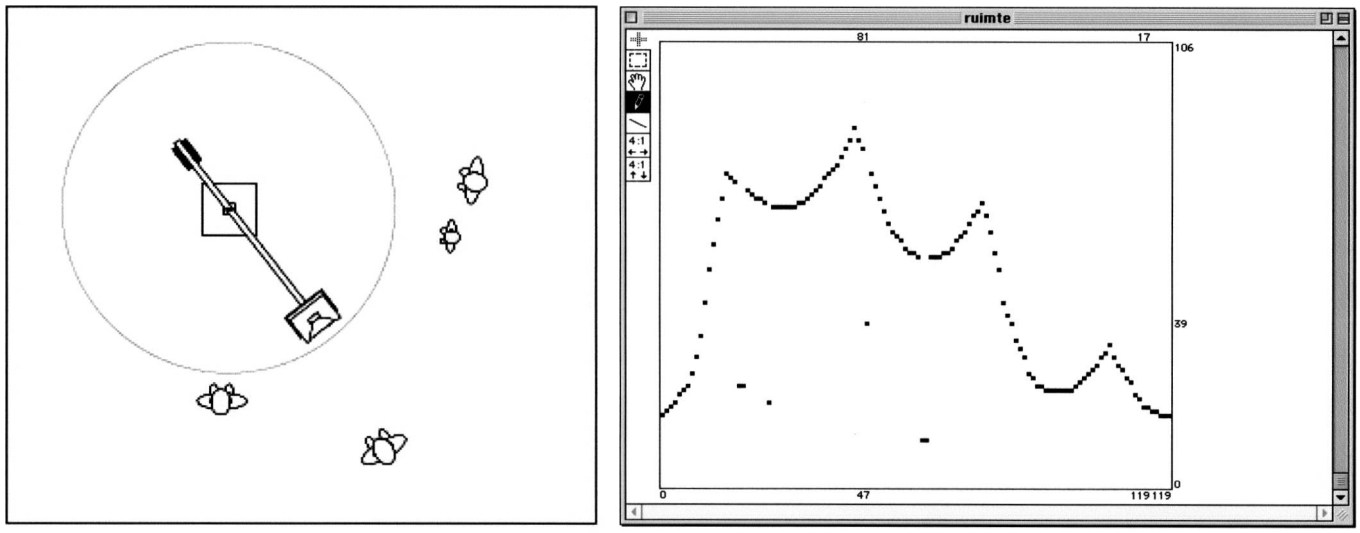
Spatial Sounds and the space

It's essential for Spatial Sounds to be able to separate the visitors in the space from the space itself. Everytime the installation is build up in a new space the installation first has to learn the shape of the space. This is done in the following way:The installation is spinning slowly in the empty space. For every possible angle the arm can make, the actual measured distance is stored in a table. The result in the table will be a two-dimensional map of the walls (and other objects) in the space.
After the table has been stored the installation will be able to recognize the visitor because at the place the person is standing the measured distance will be shorter then the measured distance to the wall in the table. Always the current distance measurement is compared to measurement stored in the table for that particular angle.





Map of the empty room



Map of the same room with four people

The interaction rules

Spatial Sounds its interaction is changing continiously. When there are no people in the space it becomes very quite both movement wise and sound wise. The arm is slowly spinning in one direction waiting for people to enter. The installion shows that it detects the visitor(s) by playing a soft sublow sound. The installation wants to be sure that the vistor is staying and waits until it detects it/them again. Then it starts to become more active. It reacts very direct with a strong sound when it faces the visitor. The timbre of the sound depents on the distance the person has to the speaker. The visitor is invited to become a participant. The movement of the installation is fully based on where people stand. The installation can follow and/or swing around the participant. It can also deal with multiple people. When there are multiple people they can really interact together. The installation is producing a stronger continious sound as well. This sound is directly related to the speed of the arm. The angle sensor is used to calculate the speed. The sound itself is not preprogrammed it's the control of the sound and the way the sound is generated, which is programmed. In this way the sound generation is directly linked to the physical properties of the installation. The software has a memory for where it has recognized people. If people are not very active (they stay all the time at the same place) the installation will start to ignore them after a certain time. The more you play with the installation the more active it becomes. However the installation can get out of control or over excited. It will stop swinging and following people and speed up very fast. The sound becomes loud and is related to both the people it recognizes and the shape of the space. The surrounding of the installation is the 'score' for how it sounds. Since it is spinning continously it will start to generate rhytmical patterns depending on the shape of the space and depending on where people stand in the space. When people stand close to the installation it will spin very fast. When people get scared and take more distance the speed will decrease. In principle the installation gets a push from every person in the room. The closer you stand to the installation the stronger the push is when it passes you and therefore it will spin faster. This out of control period can vary between a couple of seconds and a bit more then a minute depending on how close people are standing to the installation. Then it will gradually calm down again. People will be able to really interact with it again and it's behaviour changes from there again.