



## Nine sound-art installations in public space

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**The aspect of sound as a design element in an architectural context has been discussed for a long time, but there are still today very few permanent projects put into practice. The functional use of acoustics is easily comprehended when utilized to reduce unwanted noise from roads, or when it is perfected to convey speech and music in concert halls. To add sounds to create a sense of space, use it as a quality or defining identity is however still an unexplored field of knowledge. Finding the right balance between creating a quality for the space with dynamics and variety, while still being sustainable over time is challenging. The paper presents theories, methods, findings and results from a large project including nine installations. The project concerns indoor sound installations in large public spaces in Stockholm including acoustic investigations, electro acoustic installations and composition of sound installations for the specific space. The method is both scientific and art-based. The sound design is used as a way of empowering site-specific functions and architectural themes, but also in some cases as a solitary intentional characteristic quality of the space.**

### 1. INTRODUCTION

The aspect of sound as a design element in an architectural context has been discussed for a long time, but there are still today very few permanent projects put into practice. In the last two years some sound installations have been made around the city of Stockholm, which really has initiated a market but also many discussions on quality and relevance.

Tyréns is a Swedish, medium sized company with a broad profile of consultancy services within construction and infrastructure. With approximately 30 acoustic engineers out of a total of 1000 employees it is one of Sweden's top five largest centres of competence in acoustics,

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universities included. Through the Sven Tyrén foundation, the sole shareholder in the company, a close relationship is maintained with the academic world through funding of research at the universities; within the company and in various collaborations.

Within the department of acoustics in general and as a result of the collaboration with the University College of Arts, Crafts and Design through Professor Björn Hellström in particular, the field of sound design has been an emerging field for Tyréns throughout the last three years.

This paper focuses on the process of the largest sound design project for Tyréns so far and attempts to explain some of the aesthetic and technical challenges in relation to other projects.

## 2. PROJECT

Arlanda Express is a direct train service between Stockholm Central and two stations at the Stockholm main airport Arlanda. The train service and station maintenance is managed by the company A-Train AB. In the fall of 2009 the company in cooperation with BAU Architects started preliminary investigations for a refurbishment project for their terminals and platforms. In the preliminary study report BAU identified a set of important factors in making the locations more attractive, which included some ideas on involving a sound design consultant. The management of A-Train found interest in the idea and contacted Tyréns.

Based on the initial study and in collaboration with Hans Birkholz at BAU, the work of producing a concept for the entire refurbishment project was started. The basic idea was to use architecture, lighting, and sound to create a smooth and visually attractive journey with themes from Stockholm to lighten up the anonymous transits between the airport and the train tunnels. BAU also saw the need to reduce the amount of visual disturbance from the multitude of signs and texts with both information and commercial messages in various appearances that could be found at the stations.

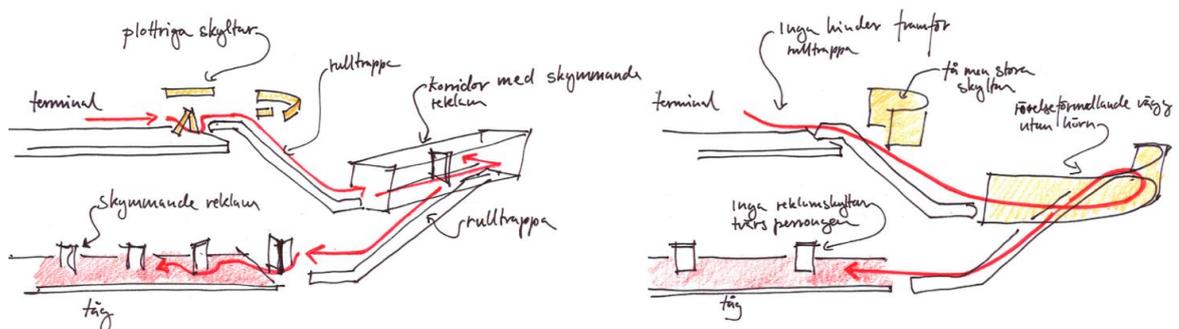


Fig. 1 - Conceptual sketches, BAU - Architects

A concept development phase for the sound design installations was carried out resulting in a proposition consisting of twelve sound design concepts, including sound installation compositions, permanent site specific room- and electro-acoustic installations and technical solutions.

The concepts were in four types. The first type is the creation of an acoustic contemplative space using speakers within an existing public space. The second type was called an “acoustic postcard” or snapshot, a composed sound trying to give the visitor an image and a feeling of a typical Stockholm location. The third type is a literary theme composition that illustrates a novel or poem strengthened by stylized visual elements. The fourth type is related to elevators.

In the original concepts there was also much focus on accessibility that included speaking information tablets, guidance sounds to the train doors and several architectural measures. The section was postponed after discussions with the Swedish central organizations for the hearing- and visually impaired.

### **3. GOALS AND CHALLENGES**

The overall goal for these permanent sound installations is focusing on aesthetic quality and long term sustainability. Also from the clients point of view it was clear that the idea of the refurbishment project was to raise the standard of the sites and the quality of the experience for the travellers.

Some general ideas have been central in most of the sound design installations. The idea of moving the focus from the surrounding to create a more private and hopefully relaxing space is one that is a development of the earlier Gallerian project<sup>1</sup>. Another is the concept of using sound to alter the size, or perception of space in a room. This can be used both for reducing the size as in dividing a long corridor into several smaller acoustic spaces, or varying the sound field to get a sense of direction to a certain target point. In other cases it can be used to enlarge the feeling of a small space. Specifically for this project was the idea of making the trip feel shorter for the travellers by adding variation and creating new possibilities to discover and have a different experience every visit, a method that we call “slow sound design”.

The challenges were how to handle the acoustic prerequisites of the space itself and how to make sounds that blend into the existing sounds of the place, while still being non-related i.e. acousmatic<sup>2</sup> in character. This has relation to the need for sustainability. It is not a big effort to create a sound that attracts attention, but to create a sound that draws attention from other sounds without being tiresome or disturbing in itself is a challenge. The background sounds from escalators, trains and other installations are in many cases high and it was not possible to “compete” with them energy wise using the speaker sounds. On the positive side, many of the spaces are only quickly passed by the traveller which gives a lot more room for dynamics and character than for the spaces where people stay and even work daily.

### **4. SITES**

The selected sites for sound installations were two escalators going from the south platform up to the airport terminals, two corridor rooms that bind together escalators from the north platform to the airport terminals, one waiting area at Stockholm central station and one waiting area at the Arlanda south platform and also all the elevators going from the platforms to the airport terminals.

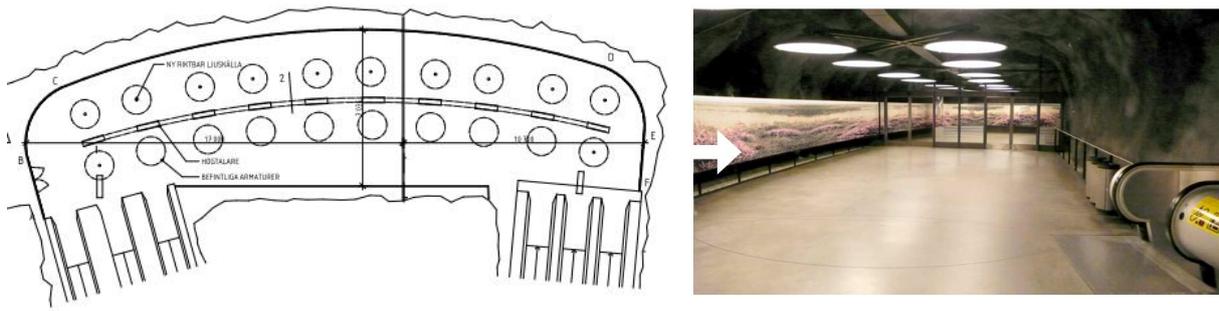


Fig. 2 - One of the corridor rooms connecting two escalators at the northern platform

(Graphics by BAU)

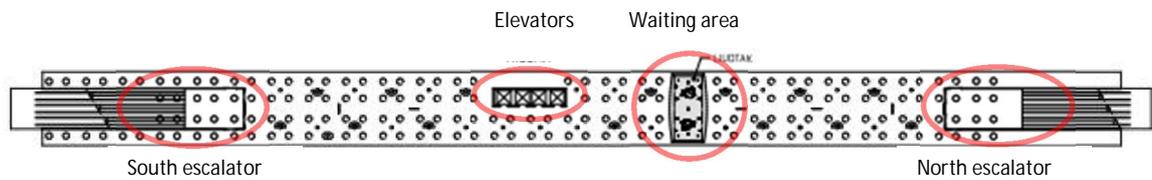


Fig. 3 - Drawing of the northern platform with elevators and waiting area

## 5. THEMES

For the corridors, BAU designed large long stretched wall images with motifs from Stockholm. One image is picturing the Stockholm Old Town waterfront and the other showed the barren islets of the outer archipelago. The first room had a low ceiling height and straight angles whereas the second, archipelago room was slightly curved with a bare rock ceiling as shown in Figure 2. The conceptual idea here was to empower the visual design and dampen the feeling of the room by adding sound that related to the images while drawing some attention from the cave-like room and the noisy escalator machinery. In the initial concept there were also suggestions of using scent to even further transport the beholder to the pictured sight.

The two escalators had mainly bare rock ceilings with hanging beams for the lighting installations. In these sites the themes were suggested by the sound designers to be literary. In the year 2012 there is a jubilee on one of Sweden's most famous writers August Strindberg, and since he has very thorough artistic descriptions of sound in some of his works it was an interesting challenge to make the descriptions from the beginning of his novel "the Red Room" and compose them back into actual sounds again, only explained to the listener by some stylized characteristic objects in display cases at the sides.



*Fig. 4 - Escalator with speakers and display cases (close-up on right)*

For the second escalator a more modern writer with many opposites but also some connections to Strindberg was chosen. Sonja Åkesson was a poet and writer with her main works produced during the 60'-70's. In Sweden she is considered a strong voice for the women's liberation movement as opposed to Strindberg's despotic and conservative views. The main common for the two apart from being writers is that they both lived in the same block of buildings at Drottninggatan in central Stockholm. Åkesson has several poems around the theme of modern living and urban social conditions including some airport related elements which fit well into the project.

For the two waiting spaces the idea was to compose subtle contemplative sounds that utilized the effect of *informational masking*<sup>3</sup> to create a space where people would be less disturbed by others conversation or sounds from installations and activity throughout the train station. A theme of four "elements" was composed with wind, water, fire and earth related sounds all combined through a noise based common timbre. The normal waiting times are only a few minutes but using the idea of "slow sound design", a composition with five minutes of each element was made with long transition periods between the elements so that a visitor will only experience maximum two elements at one given visit.

Another concept featured in the same acoustic space within the open area of the train platform was that a visitor should be able to interact with the space and through a panel change it into a snapshot of various famous Stockholm environments. Four different selections were made possible, the Nobel banquet, the Skansen outdoor museum, a summer night walk through the city and the busy life on the street Götgatan. The snapshots are also compositions like the acoustic postcards but more specific to a location, for example the acoustics of the "Blue Hall" where the Nobel banquet is held was actually measured and sampled for use as convolution filter on the sound samples and the environment at Götgatan was binaurally recorded and used as a basis for the snapshot composition. In addition to listening to the snapshots, the public also has the possibility to connect a mobile device to the system and play back their own music through the filters to try out how it would sound at those locations.

The elevator concept consists of both an ambience inside the elevator and a new composed arrival sound. Using both light and the new sound, the idea is to increase accessibility and promote the use of elevators since the escalators are not suitable for heavy luggage transport, and also to naturally connect the arrival sound to the ambience as the door

opens. Following studies, the attack of the signal should be short with a broad spectrum<sup>4</sup>. The sound composed for the inside of the elevator is a contrast to the highly mechanical and metallic appearance. A sound with elements of forests and large reverberation is meant to make the elevator cage feel larger and less cramped than it actually is.

## 6. METHOD

An important note is that it does not work well to record a sound field, and then play it back in the new space. Naturally the description in Strindberg novel is of Stockholm in the 19<sup>th</sup> century where you had very different sound sources than today and could hear church bells over miles. But also in reproducing contemporary sources, the perception is not the same when played back through speakers in a new location. It became necessary to clean up the sound field from elements that the brain would normally filter out at the actual location. Also in order to recognize the sound field when detached from the visual perception it was necessary to put extra emphasis on the characteristic sounds and defining properties of the sound field.

In the Arlanda express installations the above was realized using a method of layering *background sound* with characteristic *accent sounds*. The “acoustic postcards”, the snapshots and the literary themes were built up by around 20-30 different sound files each. The accent sounds were panned in the multichannel wave file which could give them a high sense of direction and movement in the room whereas the backgrounds were more or less stereo mixes of several files with various amounts of automated filters, reverb, compression and level control to receive the wanted dynamics and temporal variation. To add another dimension to the installation the accent (or artefact) sounds were also layered so that some of them were used together with the background for a more or less metabolic environment<sup>5-6</sup> where as others were designed to stand out drastically from the background and “open a window” to the perspective of the writer, as a parallel to the display cases on the walls. The length of the compositions were almost three times as long as it takes to pass the installation so for each new visit it is possible to discover new sounds and clues to the complete work.

The installations are *compositions* with elements from many different recordings, not unlike the sound design of a feature film but with the added aspects of attentional masking, partial energetic masking, the site specific adaptation of frequency and material content and some purely artistic compositional ideas.

All of the installation spaces inherent sounds were recorded and used as reference in a quadrophonic mixing set-up to find sounds that could blend with the surroundings and to avoid sounds that would not reach through the background noise. Even with these measures the result is not entirely predictable, for some of the installations up to 5 rounds of revision had to be made with listening tests to achieve a both acoustically and aesthetically acceptable result.

## 7. TECHNOLOGY

The platform spaces themselves had very low sound levels but were highly reverberant and the risk of disturbance from phone conversations etc. was high. However there was an interest in the project not to build walls or screens in the very open space of the platform. A design was made of a 10m x 5m “Sound wing” that spans across the platform, covered on the inside with sound absorbing material, speakers and lighting and then covered with a metal grid to make it a flat surface with the speakers totally concealed.

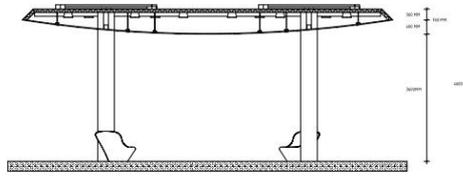


Fig. 5 - Cross section of waiting area with the "Sound wing"

Since two sides of the wing face the train tracks it was possible to use simple line array speakers to create a well-defined exposed spatial area of sound. This gives the distinct appearance of coming in and out of the sound atmosphere as you walk along the platform, a so called cutting effect<sup>7</sup>. The absorbing material reduces a lot of the reflections from the platform floor creating a locally lower reverberation time which also helps the illusion of coming in to another room. With merely a stereo signal a very high sense of "being in the atmosphere" was achieved.

For the escalators, 15 simple two way public address speakers were used in a 6 zone setup as seen in Figure 6. From a 6 channel sound file it was then possible to reproduce some diffuse or atmospheric sounds and also create diversity through the placing of localizable accent sounds in different zones.

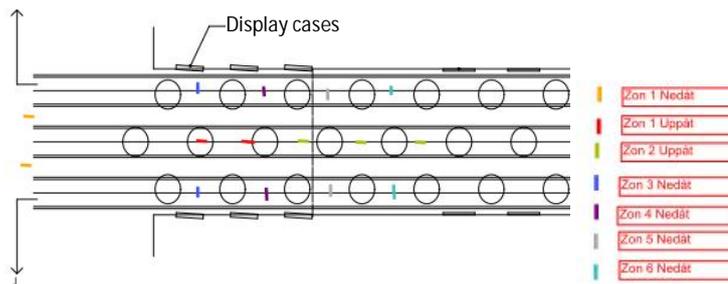


Figure 6. Escalator plan with speaker placing, speakers in the middle row (zone 1 and 2) facing upwards to the ceiling

The two binding corridors had two different speaker placings, the first one had a bare rock ceiling as seen in Figure 2, and an archipelago theme. Here line array speakers were mounted from a beam hanging in the middle of the room facing upwards in order to get a big and diffuse sound field. The second corridor had a lower absorbing ceiling and an inner city theme; the line array speakers were mounted directly above the wall image in the corner between wall and ceiling to achieve a sense of the sound coming from the wall. Both installations had 12 speakers divided into four zones.

For the elevators, two simple ceiling speakers were mounted inside each elevator and a stereo active speaker column (originally for use with a flat screen TV) in the light fitting above the doors outside for the elevator signal. A trigger signal is extracted from the elevator control system and used to trigger both light and the added sound.



*Fig. 7 - Sound and light installations at elevator door*

The whole system is built around a central mainframe that contains sound files, filters, triggers etc. All of the technical installations were carried out by the company AV-Produktion, led by Michael Collin who has also been a big contributor in the development of the technical solutions.

## **8. LOCATION SPECIFIC ADAPTATION**

None of the locations mentioned in this article had optimum prerequisites for a sound installation. Both the noise level and the room acoustic properties of the spaces had to be taken in to account in order to make the added sound natural and plausible in that context. The most problematic room in this sense was the archipelago corridor shown in Figure 2. Background sound recordings were made early in the project and were used together with the compositions in the listening environment to get a sense of the end result, also the room acoustic response including reverberation time was measured. However for this room the noise levels were higher and the room reverberation time was problematic in many aspects. The chosen speaker configuration with all speakers directed toward the ceiling was very sensitive to the resonance modes in the room and a large portion of the lower frequency range did not at all add to the sought effect of the added sound. The composition had to be revised several times after tests in the actual room.

Another adaptation of a more basic nature was the arrival sounds of the elevators, since the company responsible for the elevator systems were reluctant to remove the existing signals of the elevators for security reasons, and the elevator systems were of simple design with varying pitch. 4 differently pitched new signals had to be produced to match the existing ones.

## **9. RESULTS AND FINDINGS**

Most of the sound design work described here are developments from the Gallerian<sup>1</sup> and Mariatorget<sup>8</sup> sound installations and accompanying research projects in Stockholm.

It is clear from both the Gallerian project and early indications from this project that the contemplative sonic space concept, as used here in the waiting spaces, has an effect on

people's behaviour. Since the cutting effect of walking in to the space is quite defined, some people clearly notice the installation and stop to listen. Many other visitors seem to adapt fairly quickly to the space, using the different functions of the installation without consciously treating it as such and for example move into the space when in the need to speak privately to each other or over the phone. In the same way as some move out from below the wing to find a more quiet place.

One of the most important aspects of the sound installations is that they are in fact a combination of aesthetics, acoustics, art and function. They are compositions and technical installations based on scientific theories on acoustics and perception that have function both as an art installation and as a functional means of varying and enriching the experience for the travellers.

As the sound is decoupled from clear visual content or textual descriptions, the field opens for imagination among the listeners. This can in some cases lead to problems, for example a church bell sound from the Strindberg composition was by a few listeners related to funerals and caused worries related to their fear of flying. In other cases it will merely cause some confusion as listeners associate to jungle sounds when they listen to a suburban soundscape with some common Swedish bird song.

In any occasion the realizing and launch of this large series of installations plays a part in the development in using acoustics and sound as a design element and shows the strengths of concepts that are both multi-disciplinary in development and in their realization as a combination of function and art.

## 10. REFERENCES

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