Abstract
During the design phase of a building, the architectural concept seldom includes the room acoustics. The architect focuses mainly on the sense of seeing, and the acoustics are a side issue which are not part of the architectural design. Some architects however, are of the opinion that the acoustics are important for the atmosphere and the perception of space. I am of the same opinion, and think that there is both something wrong with the way we design as with the way education focuses only on the seeing sense.

Keywords
Room acoustics, senses, perception of space, atmosphere

Architectural atmosphere
According to the architect Peter Zumthor, architectural quality is, at least for him, when a building moves him, which he describes as atmosphere.1 This is experienced with all the senses together. Most of the time it seems that the architecture is designed regarding the eyes only. But according to some architects, one of our most important senses for the perceiving of space, dimensions and material, besides the eyes, are the ears. Different opinions on the matter seem often taken unconsciously, because there is not written very much about the question whether room acoustics are part of the architectural atmosphere or not. However, some architects did write about the theme and a lot of architects show their opinion by their way of designing.

Architecture is a visual art,
Many architects unconsciously take in the position that room acoustics are not a significant part of the architectural atmosphere. Room acoustics is often seen as purely an engineering matter, and when looking in the involved parties in architecture magazines like Domus, it seems the consultancies are only consulted when the acoustics serve the primary function. According to Julian Treasure, who gave a TED Talk about acoustics in architecture, architects tend to focus on the eyes only.2 Architecture is often called a visual art, like the famous quote of the American architect Julia Morgan:

“Architecture is a visual art, and the buildings speak for themselves.”

In Vers un Architecture (Toward an Architecture), Le Corbusier poetically describes architecture as “the masterly, correct and magnificent play of masses brought together in light”, which he continues with the importance of the eyes for the experience of architecture.4 This partially shows Le Corbusiers position regarding acoustics in architecture, by correlating architecture primarily with the eye and its function to see.

The Bexley Business Academy is a striking example where the primary focus is on designing with and for the eyes. The academy was designed by the architecture firm Fosters + Partners, and featured an open plan where the classrooms had no back-wall at the side of the atria. This caused unintelligibility in the classrooms, which made the receiving of information very hard. Later, the glass back walls were added. It is not surprising that the key-feature, transparency, is a feature entirely dedicated to the eye. It won the RIBA national award and was short-listed for the Stirling prize.5 This is also an example where the jury falls for the visual part of architecture, while the building initially did not even work properly.

Also in big design competitions, room acoustics are a side issue, even when it comes to buildings which above all demand good acoustics. The competition of the Sydney Opera House, was won by the architect Jorn Utzon. This building

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2 Treasure, J (2012), Why architects need to use their ears, TED Talk
3 Morgan, J.
4 Le Corbusier (2008), Toward an Architecture, London: Frances Lincoln
became an icon of Sydney itself. However, shortly after the completion it became clear that the room acoustics of the opera house were dramatic, and some revisions had to be made in order to make it proper. This is both the architect and the assessors to blame; the room acoustics were not, or not well, integrated in the architectural design, which causes the need for additions which may not fit the original concept. The assessors seemed to focus on the creation of an icon, according to Lawson.

In architectural magazines, the reviews of buildings concerns themes like space, material and organization, but seldom the acoustics are reviewed. Actually, it sometimes seems like the acoustics are only mentioned when it is troublesome, like in the previous mentioned examples about the Bexley Business Academy and the Sydney Opera House.

The examples matches a view on the branch of architecture and shows their opinion about the relevance of acoustics in architectural concepts.

Room acoustics are a significant part of the architectural atmosphere
This view on the importance and relevance of room acoustics for the perception of space, is not something of the last ten years. Steen Eiler Rasmussen talks about the experience of architecture and in chapter 10 he says:

"We are seldom aware of how much we can hear. We receive a total impression of the thing we are looking at and give no thought to the various senses that have contributed to that impression." 7

Imagine entering a room with a lot of heavy curtains hung beside the windows and a very soft and thick red carpet. One could perceive the space as warm and intimate, while only referring to the colours, being unaware of the fact that the absorbing materials like the carpet and curtains results in low reverberation times, which is associated with small spaces. Because both users and architects are often unaware of these effects, the room acoustics often do not get a proper design but rely on coincidences regarding dimensions and material.

Pallasmaa writes in Eyes of the skin about the effect of room acoustics and mentions the difference between sight and sound and the complementation. They both act different and we act different upon the different stimuli which we retrieve via the two senses. Pallasmaa sees a great distinction between the two, but especially acknowledges the importance of hearing for the impression of rooms and spaces:

"We are not normally aware of the significance of hearing in spatial experience, although sound often provides the temporal continuum in which visual impressions are embedded." 9

He explains this with the example of a movie, and how the movie is perceived differently when the soundtrack is removed from it. He describes the effect as letting the movie lose its plasticity and its scene of continuity and life. When cutting the sound from a movie, one can imagine to be less immersed into the movie, it feels as if one is more outside of everything happening in the movie. This illustrates the importance of sound, and Pallasmaa mentions how “sight isolates, is directional and implies exteriority, whereas sound incorporates, is omnidirectional and implies an experience of interiority.” 10 This explains why the lack of sound removes immersion, but also how sound and sight complemet each other.

The ears are the main sense used by blind

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7 Rasmussen, S.E. (1959), Experiencing Architecture, p.224, MIT press
8 Pallasmaa, J. (2005), The eyes of the skin, architecture and the senses, p. 48-72 John Wiley & Sons, Chichester
9 Idem
10 Idem
people, to move through buildings, but also to experience the atmosphere of buildings, as described by the blind architect Chris Downey in a TED talk. One could say that the blind people perceive space in a different way than deaf people, but this shows a different perspective on the architecture than Le Corbusier’s description.

**Author’s position**

‘Architects should start designing for our ears.’

During my attendance at the faculty of architecture, during design meetings of projects, me and my fellow students were often asked about atmosphere related matters of spaces. Tutors would often discuss about the lack of daylight, about sterile materialization or the form of spaces and whether something is a climatic buffer zone and whether the temperature would be appreciated. However, I can not recall one moment when a teacher would say something about the materialization and dimensions regarding the room acoustics. Acoustics seem hard for architects to understand and they are often unaware of their contribution or effect on the human experience of space and on our mental and physical health. Partially because of their unawareness, as soon as they start teaching, they will not teach about the relevance of acoustics.

In my opinion room acoustics should, like light and material, be a tool of the architect to design the atmosphere of spaces. It is a shame that a lot of architects cannot use this tool, because they have not learned its importance nor how to deal with it. This, as mentioned, starts early, from the offered education by the faculty. I think, that by being able to use acoustics as a way to form atmosphere in buildings, a much richer atmosphere can be created, where the acoustics strengthen the architectural concept.

One of the reasons architects can come away with lacking an acoustic design, is due to their methods of discourse. The entire design exists of drawings, some descriptive words and the architectural specifications. Whether it are sketches, AutoCAD sections or 3D renders, the method of communication is also focused on the sense of sight. This works for most atmospheric values, since we can make us an impression of how much daylight there will be, if the materialisation is suitable for the atmosphere and if the dimensions fit the function. This is why tutors often discuss these themes. The reason why we do not discus acoustics during the design meetings is because on the one hand, like Pallasmaa described, we are often unaware of their additive value, and on the other hand because the methods of discourse are not suitable for imagining how the space would sound. The combination of unawareness and the difficulty of imagining how the space sounds, makes that the architect does not easily changes the way he approach a design question.

Auralization can be an architects’ aid in the imagination of how buildings sound. Auralization is a technique where rooms are modelled in 3D by designing geometry and applying acoustic properties of materials, which is then simulated. This data is then used to simulate the sound inside the building. In combination virtual reality, this can help architects to have more control over the design of atmosphere of buildings.

**Conclusion**

The discussion about whether the acoustics are part of the architectural atmosphere, is often conducted from one side; the architects and the people who think a lot more attention should be given to design of proper room acoustics. A lot architects and teachers however,
seem to unconsciously take the position of that architectural atmosphere in buildings is primarily a visual art, and that acoustics are more of an engineering matter.

I am convinced that it is the responsibility of the architect, to design acoustics that fit the function and match the architectural concept for a design question, and that although it can be a real challenge, it can be a powerful tool to create the atmosphere an architect has in mind.

**Literature**


Pallasmaa, J. (2005), *The eyes of the skin, architecture and the senses*, p.48-72, Chischester: John Wiley & Sons


