The thesis questions the frequent lack of acoustic awareness in architectural education and practice. Through its specific project, it wishes to identify, devise and use a number of tools to help integrate aural considerations into the architectural design process. One such tool is the creation of a library of acoustic spaces: compiling, cataloguing and analyzing aural precedents in architecture. Another is the use of audio-editing software capable of modeling tridimensional spaces within which a sound is projected and reacts. To apply these tools, the proposed project is the partial relocation of the Maison Radio-Canada to the east of its current site. The thesis will focus on the acoustic response to the various pieces of program: recording studio, exhibition hall, offices and communal rooms, exterior plaza/amphitheatre.

Supervisor:

David Theodore
Thesis Premise:

Architecture is always far more (or less) than what is initially designed. The reality of the built form, the way it is used and the way it itself impacts its context in return can never be entirely predicted. However, certain aspects of this final result are not merely incomplete in the design phase, they are sometimes entirely missing. The acoustic experience of buildings today is too often neglected in the design process. This can sometimes lead to pleasant surprises, such as the wind singing between the plates of Berlin's Northern Embassies or the way the crowd's footsteps echoes off the skyscrapers' facades at La Défence, but quite frequently also to disappointing annoyances (the dull THUNK, THUNK as you walk on the raised floors of Montréal's Grande Bibliothèque).

The thesis wishes to address this matter by proposing a series of tools for the architect to use for acoustic design. These can be a library of acoustic precedents, where aural experiences are distilled to a specific vocabulary describing sonic effects and the architectural features that create them. They can also stem from the use of audio-editing programs designed to reproduce the acoustic of any tri-dimensional space. These devices, and others still, will be tested out through the thesis project; an extension to Radio-Canada's current headquarters in Montreal hosting new recording facilities, offices, concert and exhibition halls, as well a public outdoor space to act as an amphitheatre.
Primary Area of Study: Acoustic Design

"The modern architect is designing for the deaf. His ears are stuffed with bacon." This is the sad realization composer R. Murray Shaffer comes to in his 1977 book: The Tuning of the World. He argues that aural matters in the profession of architecture today are too often an after thought, restrained to the issue of "sound reduction, isolation and absorption" (Shaffer 1977, 222). Rarely, outside of designing specifically for musical performance, is there a concern for acoustic design. Yet any visually-based decision of space, shape and material has an impact on the sound produced by and within that environment, both at the city scale of what Shaffer has named the soundscape, and at the scale of buildings themselves.

Yet acoustically designed spaces do exist. Artists such as Max Neuhaus and O+A (Bruce Odland and Sam Auinger) and "sound architect" Andres Bosshard all comment through their work on the aural space implied in the built world. In some cases, it is done by transforming the existing ambient noise (as with O+A's Tuning Tubes), in others, it is the simple enhancement of sound propagation through the example of ancient architecture (Bosshard's Agora in Dresden). All achieve what Neuhaus describes as "removing sound from time and setting it, instead, in place." (Neuhaus, 2008)

The thesis questions the frequent lack of acoustic awareness in architectural education and practice. Through its specific project, it wishes to identify, devise and use a number of tools to help integrate aural considerations into the architectural design process.
Mode of Production: Acoustic Design Tools

The first step to integrating acoustic design in architecture will be to compile a specific vocabulary to define acoustic experiences. Jean-François Augoyard and Henry Torge's Sonic Experience: a Guide to Everyday Sounds lists and defines more than eighty sonic effects. The proposed mode of production plans to describe a series of aural precedents through written accounts and onomatopoeias, then to apply these terms as the definition of these effects: echo (CLANG---ANG), dullness (CLA), cut-out (CLAN/), mixing (CLA(bang)NG), distortion (BLANG) or delocalization (C/__LANG). Sketches, models, photos, diagrams and recordings would then be produced to document the architectural features responsible for these effects. As the list evolves, different categories of causes will most probably emerge, such as materials, shape, volume of space, level and nature of activity in the space, etc. The intent is to compile a library of acoustic spaces on which to draw as the thesis project is designed.

As computer programs can now show us with increasing accuracy the way light and materials would behave in a built project, there are programs made to simulate acoustic environments. The Rayspace program allows for relatively detailed 3D modeling of spaces in which to place virtual sound sources and microphones. By changing the acoustic qualities of the partitions and walls (absorption, scattering, etc.), one can recreate the acoustic environment of an existing space, or test the acoustic result of a proposed design. As with computer-rendered imagery, the Rayspace program will never be an absolutely accurate simulation of a soundscape, which is why it will always be used in conjunction with precedent-based examples as described above. Nevertheless, Rayspace can be a relatively intuitive way for architects to "visualize" aural space.
Site: Îlot Radio-Canada

The site chosen is the city block currently occupied by the Maison Radio-Canada. It is bound by Viger Avenue to the south, René-Lévesque Boulevard to the north, Papineau Avenue to the east and Wolfe Street to the west. Completed in 1973, la Maison Radio-Canada was to be the starting point of the Cité des Ondes, an ambitious grouping of radio and television production and broadcasting, both from the public and private sector. While many other broadcasting companies have since established themselves in the area, the site of Radio-Canada itself has stayed an island of concrete and parking, isolated from its neighborhood by high speed circulation axes. A recent proposal for the merging of Viger and Notre Dame Street into the sunken continuation of the Ville-Marie Expressway would be damaging the visual and aural landscape of the sector even further (Lévesque, 2006). A controversial project to begin with, the construction of Radio-Canada had at the time implied the demolition of more than seven hundred dwellings in one of the oldest neighborhoods in the City. Although no official announcement has been made yet, Radio-Canada has been considering the redevelopment of its headquarters' site for many years now. In addition to a return to residential zoning on the two parking lots beside the SRC tower, the possibility of converting the tower itself into high-end condominiums has also been discussed. Indeed, more than forty years after its completion, the complex is now in need of major renovations that would severely hinder ongoing production. The permanent move to a new, modern building has been implicitly considered. The thesis instead proposes a partial relocation of the SRC’s offices by building new facilities on the eastern end of the site itself. In keeping Radio-Canada on the same site, the project aims to finally start the densification of the area that was hoped for when the tower was first built.
Program: Nouvelle Maison de Radio-Canada

While part of the company will remain in the existing east wing of the 1973 complex, the tower and western part will be converted for residential use. The SRC will then extend onto the eastern 27 000 m² parking lot flanking the current buildings. The program will tentatively include a new main entrance, new offices, communal rest areas for employees, rehearsal studios, recording studios, a small, 100 seats concert venue and an exhibition space. The required parking space will be moved underground and a large amphitheatre will take its place. This last and most crucial part of the program aims to reclaim the site for public use, to be enjoyed as a plaza but also to host outdoor conferences and concerts broadcast live by the SRC.

The acoustic considerations will be guiding the design of each of these programmatic elements: from the specific insulation required for recording facilities to the shape and material qualities best suited for crowded halls or private offices. Outside, the amphitheatre will have to address both the dampening/filtering/modifying of the overpowering urban noise and the enhancement the acoustic qualities of the public space (projection, echo, etc.). In choosing the SRC as a program, the thesis will be able to extend the aural focus inherent to sound and television production to more generic programs that can in turn be grounded and defined by their acoustic environment.
**Conclusion:**

While the vocabulary and technology linking acoustics and space already exist, it is too rarely used in the field of architecture. Through the design of its own proposal, the project aims to produce and apply a series of such tools that could then be taken to any design. The same way material research or lighting design is automatically undertaken, the ultimate goal of the thesis is to prove that aural matters can and should become an integral part of the architectural design process.

**Resources:**

As a further exploration of the technological possibilities associated with acoustic design, a future visit to CIRMMT (Centre for Interdisciplinary Research in Music Media and Technology) at the Schulich School of Music is envisioned. In addition, Professor Sean Ferguson, director of the McGill Digital Composition Studios, has already been contacted for information regarding Rayspace and other audio-editing programs.
List of Primary Sources:


Penned by a team of soundscape researchers, this book focuses on the effects of sounds on listeners. In a multidisciplinary work spanning musicology, electro-acoustic composition, architecture, urban studies, communication, phenomenology, social theory, physics, and psychology, the authors and their associates at the Centre for Research on Sonic Space and the Urban Environment (CRESSON) in Grenoble, France, provide an alphabetical sourcebook of eighty sonic/auditory effects. Their accounts integrate information about the "objective" physical spaces in which sounds occur with cultural contexts and individual auditory experience. It combines accessible definitions and literary examples with more in-depth technical information for specialists. This document will be the sourcebook for the mode of production proposed above.


This book is the synthesis of Canadian composer R. Murray Schafer's involvement in the World Soundscape Project. The author argues that we suffer from an overload of acoustic information and explores ways to restore our ability to hear the nuances of sounds around us. Along with this investigation of our acoustic environment, it also proposes various methods of data collection that will inform the procedure chosen for the thesis' own analysis.


Cinema is used in order to compare architecture to an other visually-emphasized medium. Contrarily to architecture, sound in cinema must almost always be designed, fabricated in post-production. George Lucas’ first film, THX 1138, depicts a dystopian future of neon lights and white barren walls. It is only through Walter Murch’s sound design that the relationships between spaces are established. A deafening machine in one room is still perceived as a low hum in the next, ambient music filtered through panes of glass seems to move closer or further away with the changing of point of view. Inversely, the incongruous sound of thunder in a boundless white room creates an overwhelming sense of displacement. Identifying these elements all contribute to the ear training necessary to recognise aural space.
List of Secondary Sources:


Odland, Bruce and Sam Auinger. O+A. http://www.o-a.info/
Appendix: Figures

Figure 1. Rayspace interface

Figure 2. Site