HAL
open science

Constructing ideal soundscapes: a practical study on closing the gaps between soundscape studies and urban design

Daniel Steele, Nik Luka, Catherine Guastavino

To cite this version:

Daniel Steele, Nik Luka, Catherine Guastavino. Constructing ideal soundscapes: a practical study on closing the gaps between soundscape studies and urban design. Acoustics 2012, Apr 2012, Nantes, France. hal-00811341

HAL Id: hal-00811341

https://hal.science/hal-00811341v1

Submitted on 23 Apr 2012

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Constructing ideal soundscapes: a practical study on closing the gaps between soundscape studies and urban design

D. Steele[a], N. Luka[b] and C. Guastavino[c]

[a]McGill School of Architecture, CIRMMT, 815 Sherbrooke Street West, Montreal, Canada H3A 0C2
[b]McGill School of Architecture + Urban Planning, 815 Sherbrooke Street West, Montreal, Canada H3A 0C2
[c]McGill School of Information Studies, CIRMMT, 3661 Peel street, Montreal, Canada H3A 1X1
dlsteele@alum.mit.edu

Calls are increasingly made for an urban land-use policy that takes non-vision sensory modalities into account, like hearing, but agents capable of making such changes often lack the expertise to do so. The best progress in acoustics so far has been through intentional soundscape design, which considers sound during the urban design process rather than after. Indeed, soundscape designers should understand how complicated factors interact out in-situ. Armed with this knowledge, they can take action to prevent further harm to the urban landscape. The paper establishes that soundscape researchers should be working with urban designers rather than urban planners to affect soundscape change on a multitude of urban scales, because of the nature of the task of the urban designer. A mode of interdisciplinary communication is established through three case studies that show the extent to which soundscape designers should be involved in the urban design process, specifically designing rather than advising. The article cautions that soundscape researchers can overly rely on cumulative work to generate knowledge; meanwhile, urban designers, who come from specialized fields, are entrusted to think holistically about urban problems to find a solution that is satisfying to a number of agents and are generally expected to deal with more vague matters of aesthetics.

1 Introduction

Urban designers carry tremendous responsibility to their communities, from fixing up city blocks to laying out monumental new metropolises. Unfortunately, past design fiascos, such as the widely-spaced, high-rise 'Tower in a Park' housing, have created many unpopular and unpleasant urban conditions [1, 2] and aroused scepticism about their work. Soundscapes can play a large role in restoring past confidence in the building traditions.

1.1 Soundscape

The negative impacts of environmental sounds are well documented [3]. In contrast, the positive impacts of soundscape, such as enhancing a person's mood, providing a sense of community, information about activities, triggering memories, allowing a person to relax, and so on [4, 5], have received less attention. In the acoustics research community, the growing evidence that physical measurements fail to capture various aspects of human experience [6, 7] have caused a shift in focus, from noise control/annoyance to soundscape/sound quality.

1.2 Urban Design

Urban design is a term that describes the making of space between buildings. It is often used interchangeably with urban planning; however, this characterization belies urban design's focus: cross-cutting, interdisciplinary work that brings together specialists in fields like architecture, planning, civil engineering, and environmental psychology. While planning refers to the study and implementation of regulatory framework, urban design is preoccupied with the end result of interventions. From a soundscape designer's perspective, reaching out to urban designers may be a more effective solution than reaching out to urban planners for affecting positive changes to the sound and perception of the built environment.

Many urban designers have already begun to talk about the importance of sound in space [8, 9], but their observations are usually limited to the phenomenology of sound. There is a need to talk about sound in a more systematic and practical manner.

Still, there is existing dialogue about urban design that condenses the many relevant domains into digestible work relevant for practitioners. One popular and highly studied work is *A Pattern Language* [10]. The authors suggest that urban design solutions can be conveyed cumulatively, with possible urban design solutions expressed as complete conceptual images, expressing multi-domain knowledge in a culminating manner. This oft-cited work expresses conceptual drawings for over 250 cases at different scales, including a "Corner Grocery", "Connected Buildings", and a "Front Door Bench". Critics bemoan the work's finalizing tone, culturally insensitive solutions, and lack of clarity about what methodology the authors used to arrive at the existing patterns. Given that soundscape methodologies are becoming more robust and standardized, *pattern language* is a good foundation for soundscape application.

1.3 Interdisciplinary Attempts

There is a gap between the urban design and soundscape communities. First, many articles aim to give recommendations to urban designers about soundscape implementations [11-16] but are usually not publishing in journals read directly by urban designers, although there are a few scientific papers published directly in urban design journals [17-20]. Also, some aim to explore and propose new methods for reaching the urban design community [12, 14, 21], with Raimbault and Dubois pointing out the important problem that "planners [are] suspicious about noise evaluation measures since there [is] no effective balance between either technical vocabulary or measure by experts and usual description of noises." This last finding reinforces the need to convey soundscape information without words and equations.

There have been multiple large-scale efforts to address this problem in particular. First, the COST Soundscapes Project [22] seeks to shift policy attention away from noise reduction and focus on a more interdisciplinary outlook, where urban sound is a resource to be managed. They work in the context of many European cities. Second, the Positive Soundscapes Project [15] addresses that the perception of soundscape and the determination of its "positiveness" is activity-based, personal/demographic, temporal, and spatial [16]. The Positive Soundscapes Project has been concerned with the important problem of knowledge transfer to the urban planning community, especially in the context of the U.K. Another one of their key lessons is that urban planners are very focused on "scientific rationality, [thus] there is much to be overcome in any attempt to incorporate such subjective concepts as sound aesthetics" [14]. For this reason as well, urban designers may be a more receptive audience than planners to the nonnumeric nature of positive soundscape findings.

2 Urban Design and Soundscape Integration

The solution to the soundscape implementation problem is not just a simple matter of interdisciplinary work. The urban design field is not a traditional science, as it is less dependent on cumulative knowledge as a framework for investigation and knowledge-seeking. Urban designers can define their work as straddling the art-science divide. In addition, there is often no method in place for systematic evaluation of design implementations (such evaluation is often unwelcome), possibly due to the number of stakeholders each with varying ideas of what constitutes successful design, and to the amount of information the designer is responsible for distilling on a limited ground plain. This conception of urban design work means that the idea of established knowledge is not consistent throughout the field and that soundscape designers must find a new way to effectively communicate soundscape ideas, keeping in mind that success is a moving target.

This manifests itself in troubling ways. Salingaros [23] states that, "The misuse of science by modernist urbanists needs to be clarified. One reads in architecture textbooks how modernism is based on logic and the scientific method, but that is a deliberate falsehood. In fact, modernism eschews scientific inquiry." Salingaros' work, as well as that of Alexander [10], pushes for the use of "patterns" to establish and convey ground-truths about urban form. This may be a good method to convey soundscape knowledge because it conveys good practices 'phenotypically' (i.e. expressing interventions as holistic or aggregate forms with strong underlying research ideas), without limiting the creativity of the designer. The underlying research that informs the patterns would constitute the 'genotype', or pieces that one-at-a-time do not constitute a fully formed intervention.

2.1 Soundscape Design as Urban Design

Soundscape design can be considered a facet of urban design. As proposed by Yang and Kang [20], *intentional soundscape design* addresses the need for explicit thinking of sound in the designed realm, which is otherwise overshadowed by the visual modality. Those authors claim that good soundscape design is capable of expanding rather than limiting urban design opportunities.

Given the state of the field, it begs the question: are soundscape designers just performing acts of urban design? The answer is a qualified *yes*. Urban designers come from other fields as well, like planning, architecture, civil engineering, landscape. Soundscape researchers can help strengthen the credibility of urban design teams by introducing or reinforcing good methodological practice. Thus, soundscape researchers should be involved directly, not just as advisers.

A recent movement in urban design has been to adopt the Vancouver cooperative planning approach [24], where medium- and large-scale new urban design projects require a meeting with city officials to discuss objectives and constraints before any detailed design work happens. Currently, the program does not call for a soundscape designer to sit on the team representing the interest of Vancouver, but it is worth imagining a scenario where that is the case. Under such conditions, soundscape would be given more substantial weight in the early design phase, and the outcome would be worth exploring.

3 Pattern Language for Soundscape Design

Intentional soundscape design solutions entail a mixture of acoustic and urban design interventions, and this is the best justification that urban designers should not be doing all of the designing. Soundscape experts should be closer to urban designers to affect real change.

Acoustics in design is not new, but its current implementation is vastly oversimplified. Many people have presented diagrams about acoustics to architects before. In the outdoor setting, they often involve a 'source' and a 'victim' but fail to take into account the content and context of the sound [25]. New attempts at a soundscape pattern language should keep in mind the audience apart from the customer, as well as soundscape research of the last decade. One study [26], acknowledging three key parties of interest, "planners, serious listeners, and users of the space," puts forward a methodology for determining how positive a soundscape is; however, they do not offer any specific suggestions.

The work of Adams, Davis, and Bruce [14] formalizes a method for urban planners to work with soundscape experts by suggesting that the architect/developer should acknowledge the need for soundscape expertise during the preliminary design phase, then engage such an expert after a series of development proposals. While this method would represent a practical, novel, and important approach, it is worth considering the impacts of an integrated urban and soundscape design team as that work could possibly be more fruitful, as has been previously attempted [12]. One study has acknowledged that soundscape design constitutes a mixture of urban, architectural, and acoustic interventions [27], but it remains unclear which interventions arise out of which expertise, and how their recommendations will be integrated by the planners.

To further explain the idea that soundscape design interventions can be acoustic or urban, we will illustrate with case studies presented in a medium common to urban designers, namely plans, sections, and perspectives, to condense key soundscape concepts into digestible pieces. The figures will be backed up with established soundscape research, but fused more generally and diplomatically with other forces affecting the built environment, like historic preservation, lighting, transportation, and ventilation.

3.1 Case Study 1: Parc La Fontaine

Montreal's Park La Fontaine illustrates the potential for soundscape improvement without skills in acoustics. The solution was achieved solely through an urban design intervention.

Public parks play an important role in city life and quality, and the role of soundscape in parks is well established [5]. Even integrated park planning that includes soundscape is established [28]; however, a good park must also have good *permeability*, or access from a variety of points to reduce barriers to entry.

Montreal's famous Parc La Fontaine already enjoys many qualifications inside of its boundaries that make it near-ideal as a soundscape standout, like a major fountain as its centerpiece, a border of trees, shielded road sightlines,

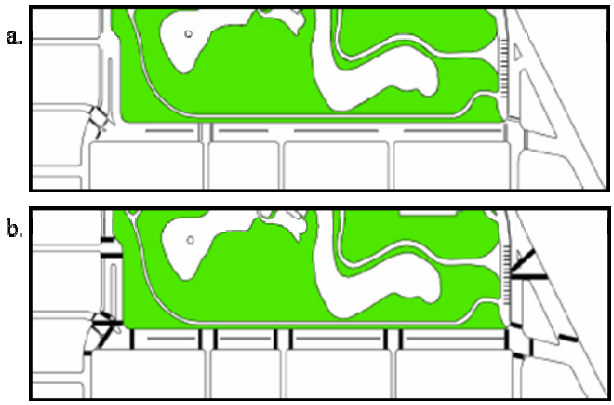

Figure 2: Parc La Fontaine in plan view. a) Before intervention; b) after intervention. New crosswalks indicated in a darker texture. (Image credit: Kris Steele).

good transit access [29], clarity [30], and clearly prescribed meeting areas; however, it has other issues. For example, it leaves much to be desired in terms of pedestrian access – getting inside the park from outside can often be difficult with up to three extra crosswalks necessary to enter from the north-west corner. Based on the finding that good access is sometimes sufficient (all other things equal) to the perception of good soundscape [18, 31], it could be concluded that better park access alone would improve the soundscape for the adjacent neighbors of the park. Thus, Figure 2 presents a solution with additional crosswalks to improve accessibility to the park with a plan to convey the idea to urban designers through their usual mode. With these new crosswalks, people within a short walk of this park will even be less annoyed by the same traffic passing in front of their house, whether or not they are headed to the park!

3.2 Case Study 2: First Impressions at the Airport

Boston's Logan International Airport, on the other hand, is a scenario which requires only acoustic design improvements to afford a better solution.

The newest terminal of the airport is loud and poorly designed, as an elevated highway hangs over the arrivals terminal making this resonant cavity a newcomer's first experience with Boston. The architect, Pallasmaa, describes a building's door handle as its handshake [9], or its tactile first experience, because the subject must reach out and touch the building. The airport's poor auditory handshake leaves many people with a poor first impression of Boston, possibly negatively affecting the region's commerce. In this case, a number of solutions can effect change and improve this unwelcoming soundscape.

The first solution proposed (Figure 1) would be a simple form change that would prevent the possibility of resonance [32] (i.e. flutter echoes) underneath the overpass. This is by no means the best solution; however it demonstrates that soundscape improvement can be achieved solely through acoustic design means.

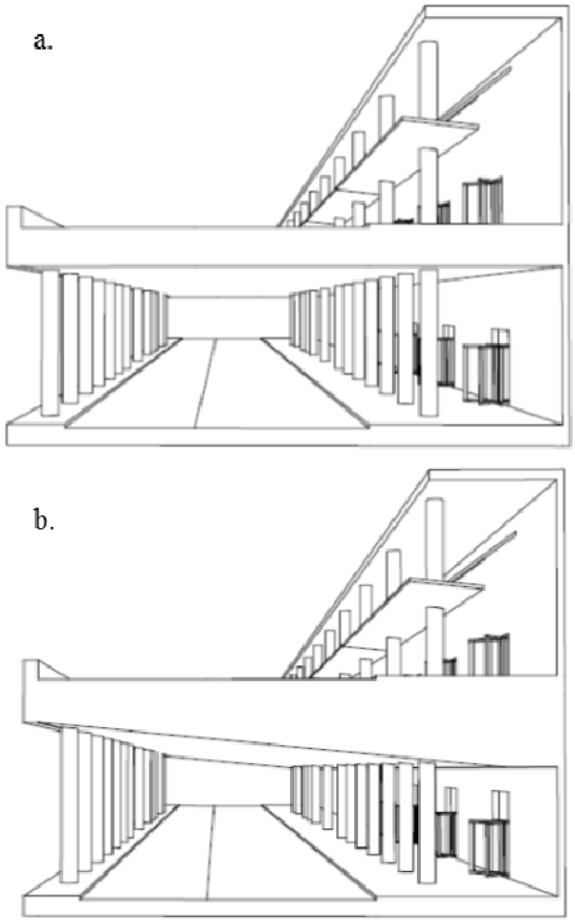

Figure 1: Airport terminal section drawing. a) Current configuration, allows resonance, unbearable soundscape; b) acoustic design change with roof slope to reduce chance of resonance. (Image credit: Kris Steele).

3.3 Case Study 3: *Re*-urbanization

The combination of urban and acoustic design interventions has tremendous potential to achieve the best possible solution. *Re*-urbanism and suburban redevelopment are predicted to be major trends in the coming years. While there is a precedent for a culminating visual solution for reurbanism [33], soundscapes are overlooked. Soundscape should be included more prominently and soundscape designers should serve a strong role.

For example, Figure 3 presents a trio of perspective drawings detailing a long-term reurbanism solution. It includes multiple time periods, from pre-intervention to many years, where soundscape figures highly (including the addition of trees, public transit, bicycle lanes, fewer lanes for moving cars, on-street parking, a sensible street canyon, improved green space, and the likely accumulation of more human and less motor sounds). The design takes into account a number of problems that don't lie in the domain of acoustic designers, like transferring parking to the public, on-street area, and giving the owners of the lots the option to build on their existing parking lots. Conversely, it also adds elements in the design that are not in the realm of the urban designer but rather the acoustics expert, such as the shape of the building envelope in the street canyon, designed to reduce resonance between buildings.

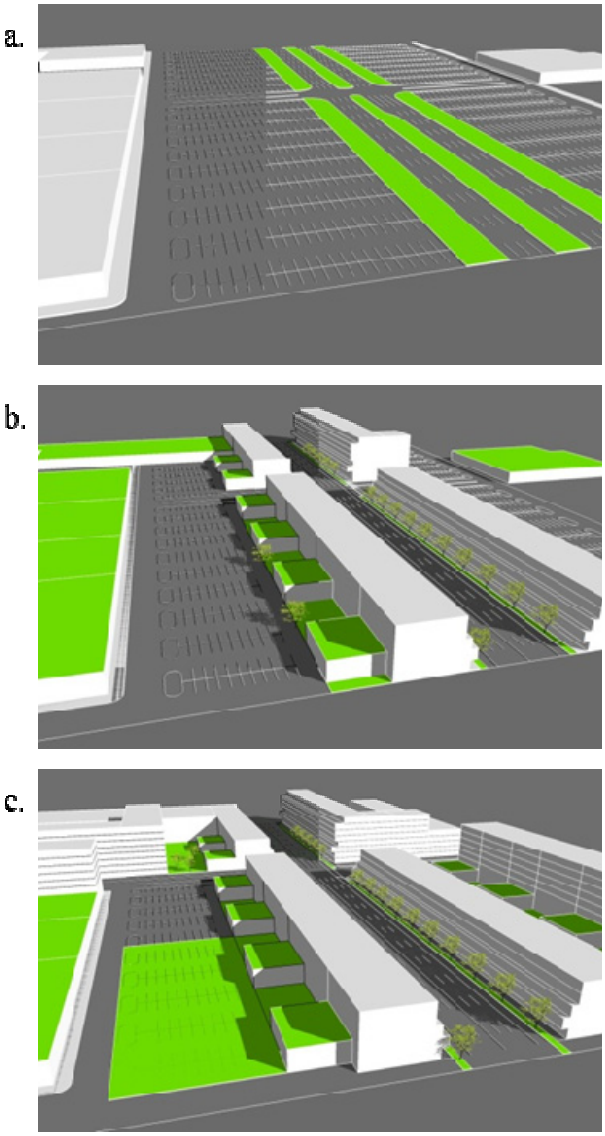

Figure 3: Re-urbanism in action.1) Current conditions, large building setbacks, car culture; 2) intermediate densification, on street parking favored over large lots, visual friction to slow cars, and new public transit offerings; 3) complete densification of neighborhood with new green space offerings. (Image credit: Francois Leblanc).

4 Discussion

The three case studies presented show that good soundscape can only result from true interdisciplinary thinking between urban designers and soundscape researchers.

The development of good implementation strategies for design should also play a role in soundscape design. The soundscape adviser must be able to exert influence on the process of implementation. Good road design is a good example of how this collaboration could produce success. The engineering of quiet pavements is a well-established field [34], yet simply installing a quiet pavement on a road, as an urban designer might do, would miss the mark. Recent findings suggest that interior levels in a car influence driving speed [35]. The urban design implication of this is that quiet pavements are likely to not meet their full potential because drivers will operate their vehicles faster on them due to the feedback change. In terms of process, a soundscape designer-as-urban designer would know that quiet pavement should come in a suite of noise reduction solutions like sidewalk bulb-outs, better street trees, and narrower lanes, to name a few. Otherwise, an expensive investment will have gone to waste. In time, however, motor vehicle operators may become accustomed to the feedback of quieter pavements and not increase their speeds. In this case, it will also help to have urban designers with soundscape or human factors expertise monitoring these cultural/behavioral changes.

In addition, the role of soundscape design in North America has been largely underexplored, with a few exceptions [27].

5 Conclusion

It is critical for the soundscape design community to reach out to urban designers specifically. First, urban design has a holistic view of needs of all domains that concern the urban space (including planning). Soundscape is in their mandate. Currently, much of the soundscape implementations of practicing urban designers is speculative. It need not be. Second, the urban design field is ripe for evidence-based methodologies, and in this soundscape research is strong. Finally, urban design is an up and coming field of importance for world class cities making key hiring appointments, since the rather vague notion of *quality* is becoming relevant as a key tool to attract people to cities.

In fact, “urban quality” consultants are on the rise. In this exciting new wave of urban thinking, soundscape can play a huge role, and now is the right time to incorporate. Soundscape researchers can use their vast toolbox and rigorous knowledge base to lend credence to the quality movement with perceptual relevance.

The current study aims to accomplish a number of goals at once: making a call for stronger interdisciplinary thinking, attempting a new way to reach a critical audience, and assembling cumulative knowledge and attempting to display it in an alternate modality. These immodest goals are provocative but could use further refinement and evidence.

We illustrated our approach with three case studies but speculate that it could be applied to many others. These studies can be broadened into a practice that takes into account the cultural relevance of continent, country, region, or city. In the North American context (as are the authors), the focus of designers may be on more rudimentary problems, such as salvaging spaces tailored for auto use in the central city. This may be a mixed blessing. Positive soundscape solutions considered during the very early stages may have better chance for legacy implementation.

Finally, good soundscape design resonates nicely with other urban design principles. For example, healthy street trees contribute to good soundscape, air quality, reduced heat island effect, and others. The authors aim to explore the many other overlapping contributions of soundscape interventions.

Acknowledgments

The authors would like to thank architecture students Kris Steele (Cooper Union) and Francois Leblanc (McGill

University) for their drawings, time, and understanding in this project, and Stephanie Yee for lending a careful eye during the revision process.

References

[1] Mumford, E., *The tower in a park in America: Theory and practice, 19201960.* Planning Perspectives Planning Perspectives, 1995. **10**(1): p. 17-41.

[2] Jacobs, J., *The death and life of great American cities*. 1961, [New York: Random House.

[3] Ising, H. and B. Kruppa, *Health Effects caused by Noise: Evidence in the Literature from the Past 25 Years.* Noise and Health, 2004. **6**(22): p. 5-13.

[4] Coyne, R. *The tuning of place sociable spaces and pervasive digital media*. 2010; Available from: http://site.ebrary.com/id/10386194.

[5] Payne, S.R., *Are perceived soundscapes within urban parks restorative.* J. Acoust. Soc. Am. The Journal of the Acoustical Society of America, 2008. **123**(5).

[6] Dubois, D., C. Guastavino, and M. Raimbault, *A cognitive approach to urban soundscapes : Using verbal data to access everyday life auditory categories.* Acta acustica united with acustica, 2006. **92**(6): p. 1060-1070.

[7] Schulte Fortkamp, B., *Soundscape: An approach to rely on human perception and expertise in the post-modern community noise era.* Acoustics today, 2007. **3**(1).

[8] Zumthor, P., *Atmospheres : architectural environments, surrounding objects*. 2006, Basel; Boston: Birkhäuser.

[9] Pallasmaa, J., *The eyes of the skin : architecture and the senses*. 2005, Chichester; Hoboken, NJ: Wiley-Academy ; John Wiley & Sons.

[10] Alexander, C., S. Ishikawa, and M. Silverstein, *A pattern language : towns, buildings, construction*. 1977, New York: Oxford University Press.

[11] SILENCE, *Practitioner Handbook for Local Noise Action Plans:* http://www.silence-ip.org/site/fileadmin/SP_J/E-learning/Planners/SILENCE_Handbook_Local_noise_action_plans.pdf, 2008.

[12] De Coensel, B., et al. *The soundscape approach for early stage urban planning : a case study*. in *Noise Control Engineering, 39th International congress, Proceedings*. 2010.

[13] Blesser, B. and L.-R. Salter, *Spaces speak, are you listening? : experiencing aural architecture*. 2007, Cambridge, Mass.: MIT Press.

[14] Adams, M.D., W.J. Davies, and N.S. Bruce, *Soundscapes: an urban planning process map*, in *Internoise 20092*009, INCE: Ottawa, Canada.

[15] Davies, W., Adams, MD, Bruce, NS, Marselle, M, Cain, R, Jennings, P, Poxon, J, et al. *The positive soundscape project: a synthesis of results from many disciplines*. 2009; Available from: http://usir.salford.ac.uk/2106/1/Davies_et_al_Internoise_2009_final.pdf.

[16] Cain, R., et al., *SOUND-SCAPE: A framework for characterising positive urban soundscapes.* J. Acoust. Soc. Am. The Journal of the Acoustical Society of America, 2008. **123**(5).

[17] Zhang, M. and J. Kang, *Towards the evaluation, description, and creation of soundscapes in urban open spaces.* Environment and Planning B: Planning and Design, 2007. **34**(1): p. 68-86.

[18] Gidlöf-Gunnarsson, A. and E. Öhrström, *Noise and well-being in urban residential environments: The potential role of perceived availability to nearby green areas.* Landscape and Urban Planning, 2007. **83**(2-3): p. 115-126.

[19] Pheasant, R.J., et al., *The importance of auditory-visual interaction in the construction of 'tranquil space'.* Journal of Environmental Psychology, 2010. **30**(4): p. 501-509.

[20] Yang, W. and J. Kang, *Soundscape and Sound Preferences in Urban Squares: A Case Study in Sheffield.* JOURNAL OF URBAN DESIGN, 2005. **10**(1): p. 61-80.

[21] Raimbault, M. and D.l. Dubois, *Urban soundscapes: Experiences and knowledge.* Cities., 2005. **22**(5): p. 339-350.

[22] Schulte-Fortkamp, B. and J. Kang, *Soundscape research in networking across countries: COST Action TD0804.* The Journal of the Acoustical Society of America., 2010. **127**(3): p. 1801.

[23] Salingaros, N.A., et al., *Principles of urban structure*. 2005, Amsterdam: Techne.

[24] Beasley, L. *"Living first" in Downtown Vancouver.* 2000 05March2012].

[25] Andersen, M. *4.401 Introduction to Building Technology, Spring 2006. (Massachusetts Institute of Technology: MIT OpenCourseWare),* http://ocw.mit.edu *(Accessed 06 Dec, 2011). License: Creative Commons BY-NC-SA.* Accessed 06 Dec, 2011].

[26] Jennings, P. and R. Cain, *A framework for improving urban soundscapes.* Applied Acoustics, 2012.

[27] Siebein, G.W., et al., *Case study of soundscape assessment and design methods.* The Journal of the Acoustical Society of America., 2007. **121**(5): p. 3113.

[28] James, P., et al., *Towards an integrated understanding of green space in the European built environment.* Urban Forestry & Urban Greening, 2009. **8**(2): p. 65-75.

[29] Guastavino, C., *Categorization of environmental sounds.* Canadian journal of experimental psychology, 2007. **61**(1): p. 54-63.

[30] Hedfors, P. and P. Berg, *The Sounds of Two Landscape Settings: Auditory concepts for physical planning and design.* Landscape Research, 2003. **28**(3): p. 245-263.

[31] Irvine, K.N., et al., *Green space, soundscape and urban sustainability: An interdisciplinary, empirical study.* Local Environ. Local Environment, 2009. **14**(2): p. 155-172.

[32] Augoyard, J.F. and H. Torgue, *Sonic experience : a guide to everyday sounds*. 2006, Montreal; Ithaca: McGill-Queen's University Press.

[33] Lukez, P., *Suburban transformations*. 2007, New York: Princeton Architectural Press.

[34] Sandberg, U., *Low noise road surfaces.* JOURNAL-ACOUSTICAL SOCIETY OF JAPAN -ENGLISH EDITION-, 1999. **20**(1): p. 1-18.

[35] Horswill, M.S. and A.M. Plooy, *Auditory feedback influences perceived driving speeds.* Perception, 2008. **37**(7): p. 1037-43.