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Expanding sonic imagination in design practices with architectural soundwalks

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Abstract

We sought to expand the horizons of architectural practice to include sonic imagination in design phases, and to investigate how people with different experience in spatial sound listening describe a soundscape and understand acoustic phenomena. Twenty-two film sound design students, took part in a two hour research soundwalk. They were given instructions to listen to the sonic environment around them, represented on a map with a 3d view of the area. They stopped at 6 locations among 30 on the map for a longer time, 4 minutes. Binaural field recordings with orientation data were made for future reference and a sound artist recorded his perspective with another set of microphones. The students were divided into listening (L) and listening and writing (LW) participants. The LW group for each location listened and described sonic textures as sources or sounding words, placing them at the center of a polar diagram. They also noted the acoustics of the places on the 3d diagrams. The LW group followed some exercises, while the L group just listened. During group discussion both groups answered questions on these locations and participated verbally with comments on the experience. Both groups matched the location numbers among the 30 places to questions asking for specific sonic and architectural features. Analysis of the data, reflections on the activity and the benefits of writing when listening for educational and awareness purposes are evaluated and presented herein.

Keywords: soundwalk, education, acoustics, aural, architecture

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1 Introduction

The aim of the research is to expand the horizons of architectural practice to include sonic imagination in design phases. Our research investigates how people with different experience in spatial sound listening describe a soundscape and understand acoustic phenomena. Existing tools allow the designer to be immersed in a simulation of the designed environment, but they are complex, and there is scarce availability of educational resources dealing with auralization [1] techniques. Thus, we study the results of adopting walking methodologies to evaluate perceptual aspects of sonic phenomena and their connection to easily recognizable architectural features.

This work arises from the research question: “Can attentive listening improve the understanding of the impact of architectural design choices on the soundscape of a place?”. We chose to conduct a preliminary soundwalk with students experienced in designing and composing sounds since they can employ a rich vocabulary for sonic textures, while describing sources and their interaction with the sonic and architectural environment.

The hypotheses we wanted to verify are as follows:

H1. When specific questions are asked, writing during a soundwalk allows the participants to focus more on subtle changes, compared to just listening.

H2. Asking specific questions on the relationship between architecture and sounds, while listening, helps build an experiential know-how which explains how sound travels in space and is affected by materials and shapes of spaces.

We also studied how participants felt about specific ambiances, the influence ambiance has on the evaluation locations, and their thoughts and suggestions about the methodology and its effectiveness in order to spread in the future this practice across architectural schools.

2 Background

2.1 Acoustic design

According to R. Murray Shafer: “The modern architect is designing for the deaf, his ears are stuffed with bacon” [2]. This provocative sentence introduces us to the field of acoustic space design. This topic is still relegated to a specialism often required only for expensive interventions as concert halls or environments where the acoustic context has to be strictly controlled as in hospitals or for urban regulation and surfaces insulation [3]. Noise has a direct effect on stress levels [4] but the practice of anticipating how a designed space will sound like is not yet diffused among architects and architectural schools, being sound design research, in the

field of architecture, mainly applied to landscape architecture [5] and acoustic corrections often applied post-hoc.

2.2 Sound walk and site writing

A soundwalk refers to "any excursion whose purpose is listening to the environment" [6] and soundwalks have been widely adopted in soundscape research [7] as a practice in different research contexts, including ethnographic studies [8], influencing urban planning policies [9][10], reflective and compositional methods [11], up to very structured systems and models as in [12], studying sonic environments directly in contact with the living material of the city and rural areas [13]. If describing sonic experiences is also a matter of vocabulary [14] it should be possible to distinguish between holistic hearing and descriptive hearing [15], and to provide in depth verbal analysis of sonic descriptions [16]. Soundwalk research has experimented with different methodologies [17], adopting psychoacoustic and annoyance measurements, spreading to architectural contexts [18], studying perception, cognition, expectation [19][20], pleasantness, vibrancy, familiarity [21]. Soundwalk research relates also to the critical understanding of space, how it is built [22] and how it can be interpreted through walking [23], and questioned through spatial practices investigating architecture from an aesthetic, social and political point of view[24][25].

3 Methods and Materials

3.1 Methodology

We wanted to find an intuitive way to reason about sound, acoustics and their relationships with architecture. Our methodology aims at finding a suitable educational strategy for future spatial designers (e.g. everyday life architects) including the practice of co-creating the soundwalk through collaborative research, as a form of critical discussion on how space is designed. Writing and answering questions in place and after, during a group discussion has been largely used as a reflective practice in soundwalk studies. The walk was designed to lead the participants through many different soundscapes in the area, as in a cinematic journey. We investigated for every location the activity of writing about the soundscape while being immersed in it, compared to the pure listening. The locations were chosen according to their level of public use (university entrance, church, market, river walkway, university courtyards, cultural event entrances) and their acoustic and architectural qualities.

3.2 Soundwalk Study Design

Several factors were evaluated while designing the study: area chosen, time available for the walk, scope of the questions and equipment needed to record the walk. Maritime Greenwich, London, UK, is an area presenting an interesting mix of green and pedestrian space accessible to the general public, away from the city, protected by the UNESCO as heritage site. In order to define the most suitable route, several other research walks took place including a pilot walk with one participant recording. The chosen walk covered indoor and outdoor locations (see Figure 1) with distinct sonic and architectural features. The walk was adapted to the two hours

lesson slot of the students. The students were divided into listening (L) and listening and writing (LW) participants. For the listening and writing (LW) group we prepared questions to be answered on paper in each 'listening' spot (in 4 minutes) on ambiance, feel, sonic textures (focusing on how participant perceived and described verbally sonic events, in order of presence to their spatial attention), acoustic field notes, satisfaction with the sonic environment, suggestions on which sonic activities would suit the place and improvements on the acoustic design.

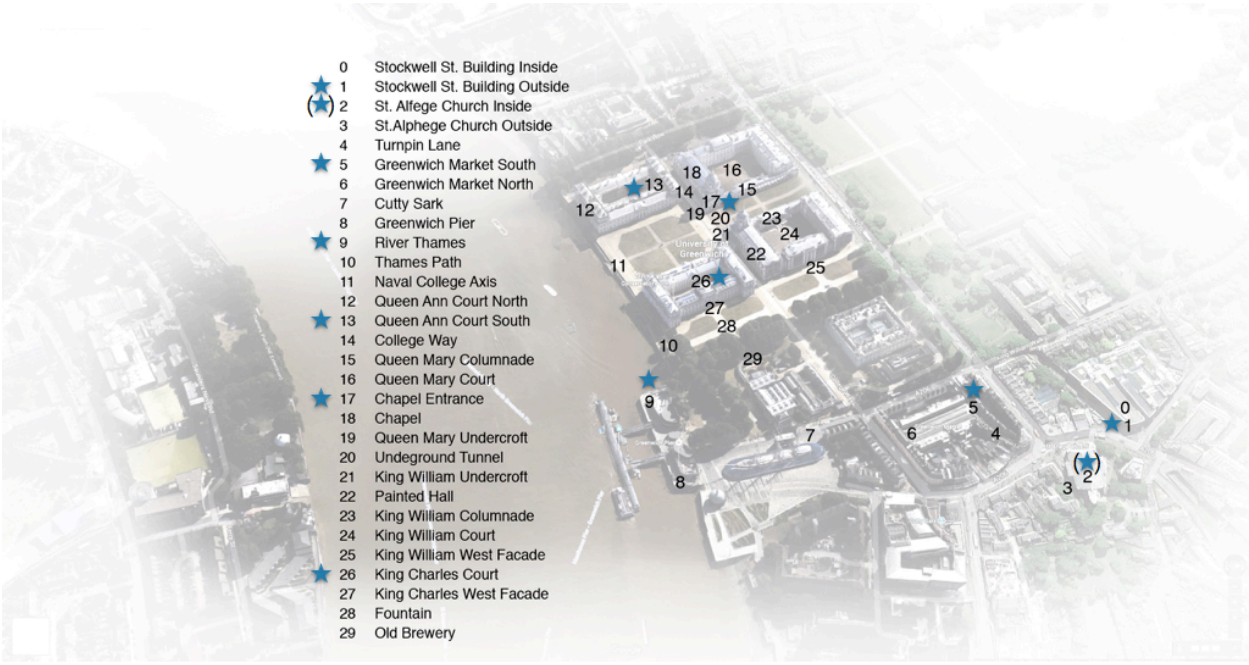

Figure 1: The soundwalk route given to the participants with the listening locations.

During the group discussion at the end of the walk, questions and conversations were dedicated to the walk and its educational outcomes, and both groups nominated places for their sonic properties (loudest, quietest, most/least pleasant sonically, most/least lively sonically, strong architectural and strong natural character). The walk was recorded with two pairs of flat response binaural microphones (DPA4060), with GPS tracking and compass logged for future documentation.

3.3 Soundwalk day

The walk started from the University of Greenwich, where the participants were explained the procedures and agreed to attend the soundwalk. The participants were divided in two groups according to their preference. 11 students from the L group and 6 from the LW group, plus the lecturer, completed the final questionnaire during the group discussion. A bike bell was placed on the stick holding the dummy ears to be rung in the predetermined locations indicated by stars in Figure 1, and notify the participants to start listening. Since St. Alfege Church (2) was mistaken as a location by all the participants, the last location (26) was not evaluated. The LW participants were asked to fill a form in each location, after about one minute of immersive listening. One of the questions was to describe the sonic textures heard in order of presence to

their perception with the help of a circular diagram with a head in the centre and some lines marking 'near', 'far', 'acoustic horizon'. This diagram was inspired by the 'listening wheel' used to help architecture students mapping a riverside soundwalk [26]. Not all participants completed the set of questions, demonstrating that a reduced version of the study might be advisable. The participants were encouraged in the activity of sound making by the sound artist, an experienced spatial sound practitioner, also recording, providing guidance in noticing how different sites offer not only unique materials, but also unique sonic effects driven by the configuration of the space itself. Whistling, snapping branches, dragging terrain and gravels, practice derived from acoustic ecology, helped participants to engage with the specific spatial sonic potential of the market, the river, the courtyard, the entrance of the chapel. Moreover, even if it was written to walk in silence, some students preferred to comment while walking, spontaneously adding their voices and their reflections to the existing soundscape. More information is available at auralcharacter.wordpress.com, including the forms used.

After the walk the group sat together in a pub to answer more questions and discuss the experience. Two sets of microphones were placed on the table and the authors ensured that participants could understand the questions asked while debriefing the walk. Some asked what natural and architectural character meant. This was explained as something peculiar to a location and presenting distinct features recognisable in the correspondent sonic environment. Some did not know what 'soundmark' meant, and this was also explained with an analogy to landmark in the visual and architectural domain similarly as in [27].

4. Soundwalk in Greenwich

4.1 Analysis

Figure 2 presents the results of group discussion where participants were asked to rate locations according to their sonic features. Almost all participants identified the loudest place with the entrance of the University, and also found it the most lively and least pleasant sonically. The quietest place was instead St. Alfege church which was also least lively and second for architectural character, with the Painted Hall receiving most of the votes. The River Thames was considered a place with strong natural character, likely due to the dominant presence of water. There was no clear 'most pleasant' location this being a very subjective factor. This 'pleasantness' [21] dimension could be correlated to loudness level and how distinguishable sources are from the background [31] but more in-depth spatial and acoustic analysis is needed to understand factors related to the built environment. Results about preference for moving water agree with [28][29]. The River received the highest number of votes (5), followed by the church(4) and the fountain (4), receiving also 3 votes for its natural character, despite its artificial nature. For each location some participants described sonic textures as sonic sources (see Table 1) whilst others chose adjectives derived from verbs (e.g. crunchy) or nominal adjectives (gravelly) [16]. Some textures related to reverberation effects (echoey, hollow), whilst many other to consequences of human activities (voices, footsteps, squeaky pram, ripping paper), evoking scenes of everyday life. Footsteps particularly revealed the textures of the floor in every location: 'concrete footsteps', 'hard,' 'stone', allowing participants to speculate on sonic

architectural interactions and bounces and reflections of sound. Regarding ambiances and feel, recurrent words were 'open', 'big', 'busy', '(en)closed', 'quiet', 'cold,' and 'spacey', 'empty', whilst for feel: 'calm', 'at ease', 'at unease', 'safe', 'secure', 'uncomfortable', and 'pressured', 'peaceful', 'absorbed', 'free', 'positive', 'unwelcome', 'significant', 'collected'.

0	Stockwell St. Building Inside
1	Stockwell St. Building Outside
2	St. Alfege Church Inside
3	St. Alfege Church Outside
4	Turnpin Lane
5	Greenwich Market South
6	Greenwich Market North
7	Cutty Sark
8	Greenwich Pier
9	River Thames

10	Thames Path
11	Naval College Axis
12	Queen Ann Court North
13	Queen Ann Court South
14	College Way
15	Queen Mary Colonnade
16	Queen Mary Court
17	Chapel Entrance
18	Chapel
19	Queen Mary Undercroft

20	Underground Tunnel
21	King William Undercroft
22	Painted Hall
23	King William Colonnade
24	King William Court
25	King William West Facade
26	King Charles Court
27	King Charles West Facade
28	Fountain
29	Old Brewery

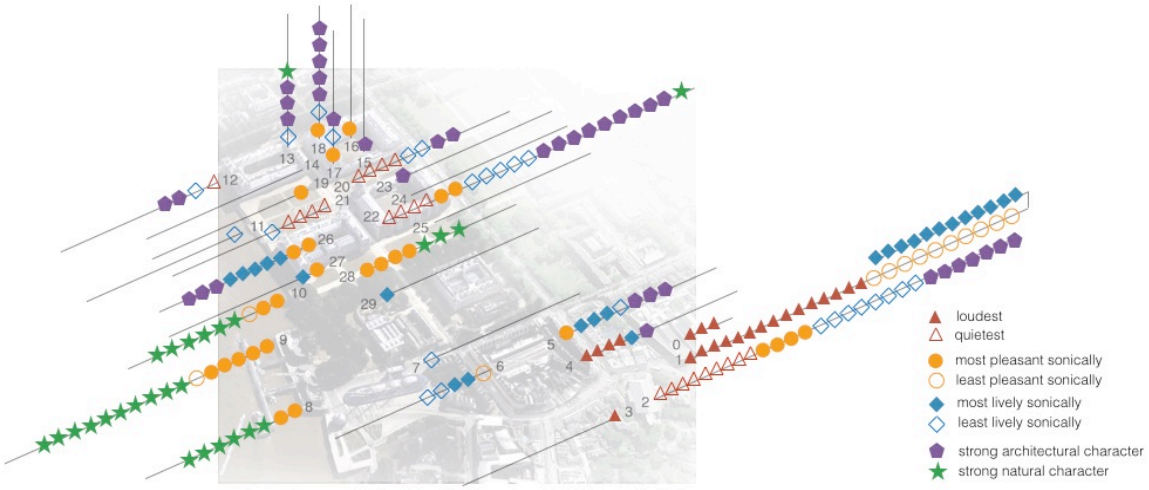

Figure 2: Results from the analysis of the answers about the sonic character of the locations.

This showed how size and architectural configuration may impact on subjective interpretation of space and how this profoundly affects mood. However, this effect is extremely variable and highly related to the emotional sphere, therefore possibly requiring tools from the field of environmental psychology [30]. Despite the locations more nominated tended to be those evaluated in detail, the Painted Hall intrigued the students for its visual richness and decorations that they decided to spend there more time than scheduled, commenting the paintings on the walls, the royal iconography and its narratives. We decided to support the free agency of the participants, allowing spontaneous reflections and comments to take place whereat evoked and inspired by the context.

We asked if architecture influenced creation and spread of sound. Many participants answered positively with supporting arguments as: 'sound bounces (off walls)', 'sound travels', 'architecture influences shapes'. Quoting a sentence which exemplifies well acoustic understanding: "Yes. Architecture shapes the space in which sound reflects. It influences the scale and type of sound." Textures of materials and the height of ceilings was also mentioned among architectural aspects having an effect on sound. When asked what a soundmark of the area could be, not everyone knew how to interpret it. Once explained, students mentioned the

automatic doors of the University (3), music from Trinity College (3), the River Thames (2), the market (1), the ferryboat (1), the fountain (1).

4.2 Discussion

The key points emerging from the study are: 1) considerations on how 'holistic hearing' [15] relates to ambiance and feel whilst 'descriptive listening' relates more to describing sound sources and their acoustic diffusion; 2) reflections on the practice of writing while being immersed in a sonic environment; 3) design guidelines for soundwalks aiming at reflecting on the sonic character when designing a space or studying it.

Location name	Ambiance and feelings	Description of sonic textures	Mean satisfaction 0 to 10
1. Stockwell Street Building	**Ambiance:** busy, dynamic. **Feel:** between calm and uncomfortable	(s)wooshing door, traffic rumble, chatting, humming, grinding, rubbing, stepping, springy, metallic (clangs), mechanical, industrial, rhythmic	5.16
2. St. Alfege Church Inside	**Ambiance:** (very) quiet and calm, reflective, peaceful, hollow, sacred. **Feel:** at unease / at ease, uncomfortable, dreary, safe, secure.	echoey, hollow, children talking, rustling, stone, footsteps, cold, wooden, cushioned, smooth, LF traffic, door opening.	7.25
5. Greenwich Market South	**Ambiance**: active, (not) busy, lively, open, closed, noisy not loud, cheery, community driven. **Feel:** calm but focused, at ease, intrigued, small, happy, eager to communicate, hungry	chatter (ing), humming, LF traffic rumble, squeaky pram, paper ripping sounds, scrapey, suitcase pulled on stone, whistling, crunching gear, metal, cold, windy, echoey.	5.40
9. River Thames	**Ambiance:** open, peaceful, loud and wet, sombre, wet and soothing, abstract, windy, fairly calm and quiet, open, busy, quiet. **Feel:** calm, peaceful, very moist, slightly at ease, sombre	water, wet, waves, slosh, swop, splashy, squeaking, screech, rumbly, industrial whining, air conditioning, boats operating, crunchy, steps, chatting, seagulls, music practice, noisy, whistling, building.	7.25
13. Queen Anne South	**Ambiance:** open, echo, spacey, cold, enclosed, very open yet contained, busy. **Feel:** annoyed, chattering, echo, absorbed, free, loud, structured, grand	echo of talking, moving voices, chatter, gravelly, crunchy footsteps, splashy, scrape, concrete footsteps, ac/electric fan, phone tone, wilhelm scream	6.50
17. Chapel Entrance	**Ambiance:** open, big, reverberant, enclosed, quiet, acousmatic. **Feel:** significant, cold and uncomfortable, unwelcome, calm, preparatory, collected.	whistling, stoney, hard, steps, ornate, heavy wooden doors, walking, talking, popping	7.00

Table 1: analysis of the results from the listening and writing group (LW)

1. Listening is obviously the first step towards familiarising with a given sonic environment, temporal changes and spatial definitions, but judgements on the ambiance of a place can become more precise by reasoning on how atmospherical impressions, once perceived or 'sensed', and captured through interviews or written answers, may derive from spatial conditions possibly caused by architectural choices or the way in which inhabitants and other environmental agents reside in a given space, the frequency of sonic production, and ultimately why these phenomena take place. Asking how a sonic environment "makes you

feel" attempts to reconcile bodily and cognitive processes, for being sound a physical phenomenon happening in space and affecting with sound waves and vibrations the entire body, not only the ears. Describing sonic textures, on the other hand, helps creating categories to qualify a space, its character and what happens in that precise moment in which we are focusing on sonic events. Descriptive listening relates to the concept of saliency [31] in psychoacoustics and foreground/background perceptual discriminations. The aim is to list everything noticeable until there's no undistinguishable background left, but only acoustic and architectural understanding of how a space 'mixes' sounds and favours certain sonic activities while discouraging others.

2. The practice of writing or being interviewed while being immersed in the space and its sonic environment is valuable for aiming at "discovering the principles by which the aesthetic qualities of the acoustic environment may be improved" [2][17]. According to Pallasmaa "quality in architecture is about atmosphere, namely when the ambience of a space fuses and heightens the sensory experience" [32][33], but the social role of architecture also contributes to soundscape definition. Writing in situ helps sharpening senses whilst reasoning on our sensorial sphere and its layers, from subtle very directional high frequency changes to low frequency vibrations spreading everywhere. This process supports both hypothesis H1 and H2, providing data which participants and researchers can analyse later, eventually collating it in sound maps and verifying what the students understood about acoustic design and how 'sound bounces off walls'. The graphic support of the 'circle of your perception', helps notating sounds as they are created, ordering them according to their saliency.
3. This walk was aiming at reflecting on architecture and acoustic design and played on the differences between heritage sites reutilised as universities, empty courtyards full of reverbs, busy and quieter riversides, the market, the church, the rumble from the street. The students had previously a meditative and relaxing walk in Greenwich Park, but bringing them along the built environment of Greenwich allows to question the role and character of architecture and what it generates. Further analysis is needed to study the meanings related to the different feelings evoked by the locations. The weather conditions, quite wet and without sun, much affected ambiance in very open places as the river Thames, whilst being less prominent indoor for the protection by the roof, the courtyard, the walls of a building. Further interviews with each one of the participant or structured conversations in situ could have enriched the data with in depth reflections on space and its structures. The practice of listening to sounds where they are created can be useful to stimulate sonic imagination and further uses for spaces, and promises interesting research directions to bridge spatial design practices and listening exercises.

5. Conclusions and future research

We presented results from a soundwalk with sound design students. The practice of writing while listening was found to be a useful tool which could be adopted to study the ambiance of a place and its acoustic features. Descriptive listening was more suitable to notice local materials, their sonic interactions with the space, and their filtering effect on other sounds, whilst holistic

hearing provided insights on how architectural parameters such as size, openness, impact on ambiance and feel, are of interest of spatial designers and inhabitants of a place. Terms like 'sombre', 'closed', 'open', 'absorbed', revealed dimensions of correlates between the built environment and the concept of being situated in a space, which is of interest of architecture students and more generally spatial designers. Hence it would be interesting to perform a soundwalk which includes focused activities as well as reflective moments on architectural systems and processes that relate to the city and its infrastructure. It would also be of interest to study how every building creates its own ecosystem of life and sounds. No psychoacoustic analysis was performed at this time. Analysis of loudness and other perceptual attributes is planned as a side measure to investigations on how binaural recordings differently inspired can convey the ambiance of the locations under evaluation. Moreover, it would be interesting to study how the practice of recording enhances or alters the understanding of a space and its soundscape, and if this could raise sonic awareness among spatial designers, in order to inspire the aural architects [34] of the future.

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