Sonification Study of San Giovanni Elemosinario

Jon Bellona

University of Virginia
Charlottesville, VA 22903
jpbellona@virginia.edu

ABSTRACT

The German philosopher Friedrich von Schelling once wrote that "architecture is frozen music."[1] Taking his insight as cue, I present a musical sonification study of San Giovanni Elemosinario, a church located in Venice, Italy. Through mapping four architectural drawings informed by contextual cues from history, I additively reconstruct the church through sound. The result (music for film) serves as a momentary fluid space for the inelastic structure.

1. INTRODUCTION

Collaborating with architecture students studying in Venice, Italy, I created a sonification study of San Giovanni Elemosinario church. Provided with sketches of axonometric views, floor plans, column details, entrances, and other structural perspectives, I attempted to sonically rebuild the church. Architectural renderings were traced with moving cursors inside Iannix. Iannix cursors output data to Kyma, where mappings control oscillators, harmonic resonators, noise filters, as well as other acoustic treatments (panning, reverb, EQ, frequency shifts, etc.). The final work compiles several tracings/data sonifications into a short "music for video" composition. While no impulse response was recorded, listening tests inside the church determined a ~3 second decay time, which helped influence the creation of spatial reverberation.

2. PROCESS

A primary concern of sonification is data mapping for "facilitating interpretation".[2] I chose what Walker and Nees would refer to as an artistic sonification[3], where aesthetics may supersede data understanding. I treated the sonification process similar to an electronic music composition process.

1. Generate material.
2. Filter generated material.
3. Order filtered material into a time-based work.
4. Tweak, revise and revisit any previous step.

However, two things made this sonification atypical. The data derivatives are not normally classifiable under standard data types [3], as they are generated by human sketch re-tracing. Second, the goal of the work was the aural recreation of a building, which does not fit a normal data sonification type.[3] The final sonic reconstruction is a second-source product, a filtered interpretation of another's perspective (architectural drawings). In the end, artistic license was indeed taken; the details of the paper outline the major aesthetic decisions in order to help facilitate future artistic sonification projects.

2.1. Data Transfer

To sonify analog sketches using technology, digital data must first be derived. I mimicked the study's approach, tracing the drawings of architectural perspective. I digitally traced architectural renderings inside Iannix, scaling the output ranges between 0-1 for each tracing cursor. Next, I routed Iannix to Kyma through Max/MSP in order to parse necessary data streams, retransmitting specified data as OSC messages or translating data streams into MIDI note messages. Lastly, I mapped the raw data inside Kyma, recording the sonic results.

2.2. Data Mapping

Each architectural sketch (i.e. column detail, axonometric view, floor plan, sectional view) received a new data mapping procedure in order to generate a new sonification. Each architectural feature (walls, arches, columns, roof) received a different mapping, although each element was treated similarly between sketches. The objective of multiple mappings was to generate musical material and to highlight the various architectural features.

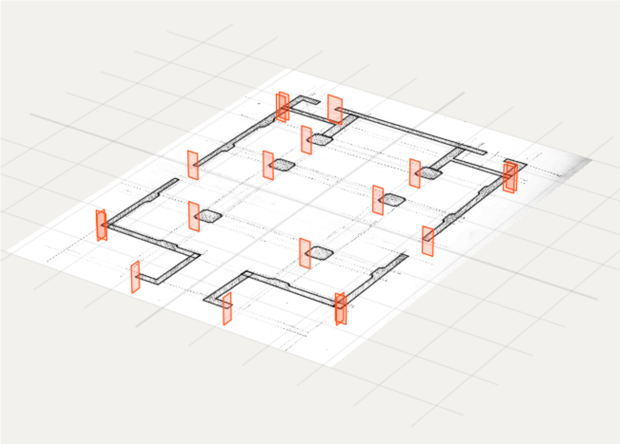

Figure 1. Cursors inside Iannix tracing the columns, walls, and entryway of San Giovanni Elemosinario.

3. MAPPING

All sonifications were created using Kyma. In order to demonstrate the sonic construction of the space and the creative process, I've outlined mappings of each architectural feature below.

3.1. Columns

Although the work begins with the church entrance, I began the sonification studies with this architectural feature. The columns are the structural support of the building, and were treated based upon their function. Structural support suggests breaking down sound to its structural elements, and taking a nod from elektronische Musik, the structural column equivalent in music would be simple sine wave oscillators.[5] Two column sonifications were used in the study– a collective of all columns as viewed from the floor plan and a detailed view of a single column.

3.1.1.Column Mapping

Renaissance architecture, like music, relies upon symmetrical proportions.[6] Six columns in the church are located in proportion to one another, and the frequencies of each oscillator are tuned proportionally. Panning within the stereo field are mapped proportionally equivalent to each column's location within the church.

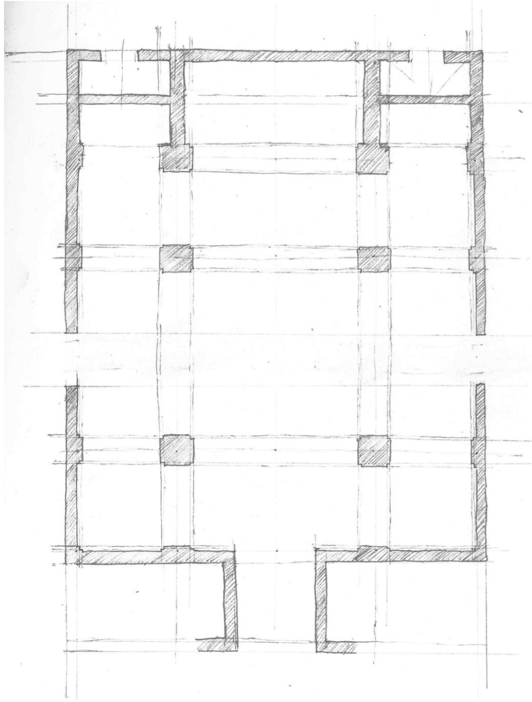

Figure 2. Floor plan of San Giovanni Elemosinario.

3.1.2. Single Column Detail Mapping

Artistic details in sketches highlight features and focus our attention, and the column detail sonification attempted to generate crisp, sonic frequencies. Each line in the column detail is traced back and forth across the X-axis, which was mapped as panning. The global Y position of these lines determine an oscillator's frequency, and slight alterations in Y position alter pitch bend. Every time a cursor reaches the extreme left or right of a line, an event triggers, sounding a granulated detail of the object.

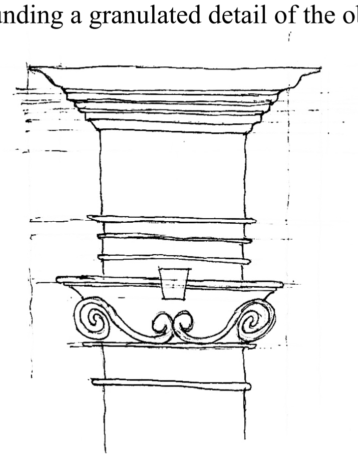

Figure 3. Cursors inside Iannix tracing the columns, walls, and entryway of San Giovanni Elemosinario.

3.2. Entryway

Entrances serve as gateways, readying a viewer for a space even before he/she crosses its threshold. In order to prepare the listener for the recreation of a church through sound, as well as to highlight the shift of one sonic space into another, I began the composition with the entryway.

The floor plan sketch was used since the drawing shows both entryway and columns, sonically functioning as both threshold and thematic transition.

3.2.1. Entryway Mapping

Because of the treatment of the first interior feature, columns, oscillators were also used for the entryway. The similar treatment enabled a smoother transition between sectional elements. Y values were mapped to oscillator frequency. To serve the function of a building's entrance, special considerations were given to the panning and reverberation. Y values were mapped inversely to reverberation and direct signal, and an additional mapping of Y values to cutoff frequency of a low pass filter sonically supports the psycho-acoustics of moving between spaces. To open up the stereo field for the creation of a new space, X values were inversely mapped to panning.

3.3 Walls

A building's outer shell is the first structural element to interact with the outside world, the walls containing the rumblings of its surrounding space. Granulation can embody small vibrations, which seem to fit this architectural feature. Each wall face received its own sine wave granulation. Y values were mapped to frequency and the cutoff frequency of a low-pass filter; X values were again mapped to panning. A mix of the granulated walls were sampled in real time into two different audio streams, granulated yet again, and mixed back in with the original granulation signal.

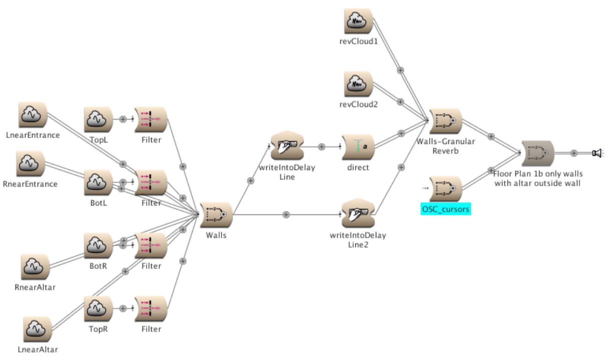

Figure 4. Signal flow of wall sonification (Granulation – LowPass Filter – Mixer – Sample – Granulation Mix + Sampled Granulation).

3.4. Axonometric View

The axonometric view of San Giovanni encapsulates previously seen architectural features and introduces one new architectural feature: the roof arch. Columns and walls were treated similarly as before, but mixed toward the background. The new feature, the roof arch, received a new data mapping.

3.4.1. Roof Arch Mapping

Physical spaces contain resonant frequencies and the apex of the inside space, the building's roof arch, seemed appropriate to highlight resonance. The circular feature of the arch reminded me of the hull of a Venetian gondola. I took a field recording of a gondola as input to a harmonic resonator. Because I did not have access to the building nor an impulse response, I abstracted a resonant frequency from the founding of the church, 1071 AD, to use instead.[7]

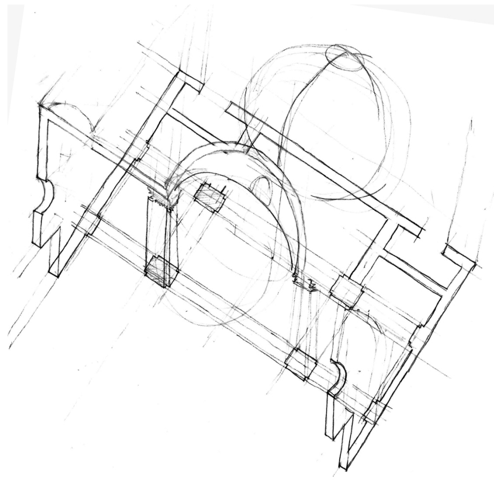

Figure 5. Axonometric view of San Giovanni Elemosinario.

3.5. Sectional View

The sectional view of San Giovanni highlights the structural supports of the roof. Therefore, I continued the arch sonification of harmonic resonance in this study. Supports of the arch created triangles of negative space, which were individually mapped to harmonic resonators. Sonically, the roof arch comes into full focus with this sketch.

3.5.1. Sectional Mapping

Negative space is just as important in design[8] as it is in music [9]. Every negative space created through the support beams was mapped. Location is an important feature of each space, and X values of these triangular shapes were placed analogously within the stereo field. While the resonant frequency remained the same for the large arch (1071Hz, from the axonometric view), all other resonant frequency mappings were derivatives, based upon the mathematical volume of the negative space relative to the main arch resonant frequency. Volumes were basic algebraic equations

$$\text{triangle} = 0.5*b*h \quad (1)$$

$$\text{circle} = \pi*r^2 \quad (2)$$

and calculations were based upon the sketch's relative sizes. I took the average of left vs. right symmetrical shapes in order to imitate symmetrical proportions of the building.

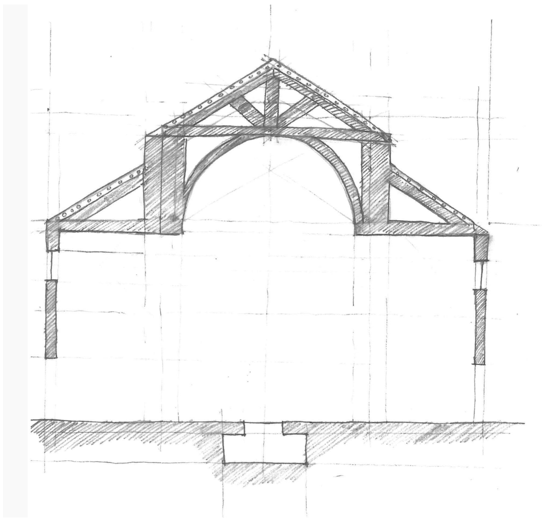

Figure 6. Sectional view of San Giovanni Elemosinario.

4. CONCLUSIONS

The final composition presents the various sonification studies of San Giovanni Elemosinario into one collected work, merging music with video. The goal of the work was to recreate the Venetian church through sound, additively, until an entire perspective was achieved. The work premiered at University of Virginia as part of the Visual Audio Sketching & Telematics (VAST) exhibition on Nov. 4, 2013, and was shown in Venice, IT at the Querini Stampalia on Dec. 4, 2013. The work is available to stream on Vimeo.[11]

Acknowledgments

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