For Those Who Died: A 9/11 Tribute

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ABSTRACT

For Those Who Died is a 6-minute dance and music tribute to those who died on 9/11. It premiered 9/11/2002 as part of a larger event entitled "Reflections, A Gift to the Community" that occurred at the Music Hall in Portsmouth NH. It features extensive textual sonification, dance, and two layers of visual presentation of nine textual datasets containing the names of those who died on September 11, 2001, the US Constitution and some DNA from chromosomes 1 and 9. The music was produced using five Yamaha QY70 and QY100 synthesizers and presented in surround sound.

1. INTRODUCTION

The music for the tribute is based directly on the textual content of the names of those who died, the US Constitution and some DNA from the Human Genome Project. The textual data is translated into music via sonification using musical encoding techniques. The final musical result contains eight tracks of sonification recorded in two sessions.

Elements of the text are displayed using two data projectors. One data projector is used as a spotlight to scroll the names onto the dancer at critical moments. The other projector displays comments slowing moving and rotating through 3D space.

The authors role in the project were as follows: Marty Quinn composed the sonification designs, produced the music, and created the 3D graphics effects. Wendy Quinn and Benjamin Hatcher developed the choreography and Wendy Quinn performed the dance.

This paper will focus on the development and use of textual sonification in the context of this performance piece. The work builds on advanced audio displays of information using musical encoding developed over a number of years for many kinds of information including ice core, seismic, solar winds, eeg, hyperspectral, air quality, radar and, most recently, gamma ray spectrometer data from the NASA Mars Odyssey program. Examples of these techniques, many of which have been used for scientific public outreach projects, can be heard at http://www.quinnarts.com/srl or at http://espg.sr.unh.edu/tof/Outreach/music/cluster.[1][2][4]

2. MAPPING TEXT TO MUSIC

The construction of language provides a rich set of codes and relationships from which interesting sonic representations can be derived. The raw materials for the current sonification use the character codes, positions in a word, rough syllable breakdown, words as whole entities, spaces between words and letters, and punctuation.

2.1. Character Code Maps to Pitch

Letters are mapped to pitches in a 7-note scale, known as a Spanish Gypsy scale. The interval steps in this scale are 1 3 1 2 1 2 2 and repeat with each octave as shown in figure 1. The notes begin one octave below middle C and extend three and a half octaves up. The ordering of letters up the scale is acebdfg, hjlikmn, oqsprtu, vxzwy. Case is ignored.
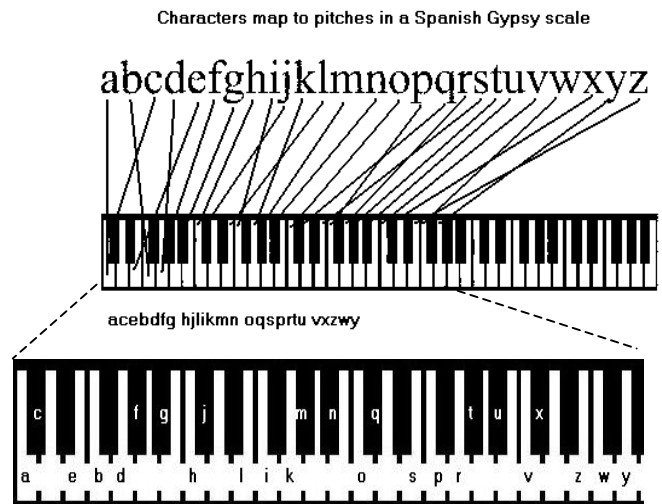

Figure 1 Mapping characters to pitch.

The selection of letters to pitches was chosen on the basis of musical interest. Instead of a consecutive and one-to-one stepwise mapping up the scale, a non-consecutive mapping was found to improve the musical results. Though there does exist an overall trend mapping letters from low to high pitches, within a small consecutive grouping of letters the relationship is not present.

The Spanish Gypsy scale is a musically interesting scale with a minor feel and containing a minor third interval step. It consists of a minor second, major third, regular fourth and fifth, with a minor sixth and seventh. This creates the possibility of a few additional types of chords than are contained in the interrval steps, 2 2 1 2 2 2 1, of a major scale. It was also found by the authors to be pleasant to listen to for long periods of time.

Additional text to scale algorithm mappings were explored. These included major pentatonic, an Indian raga, a Japanese pentatonic, a minor pentatonic, a major, and a minor scale. Some of the pentatonic mappings were a close second to the chosen Spanish Gypsy, providing an expression containing a wider frequency range and giving a sense that they could be presented at greater speeds over long periods, but the lack of chordal variety was a limiting factor in their selection. A full perceptual examination of the reasons for selection of scales and their effects in sonification, is a relevant, interesting, and broad topic but beyond the scope of this paper.

2.2. Punctuation Maps to Percussion

Punctuation marks are assigned particular notes corresponding to certain percussion sounds. For instance, a comma plays a cymbal, a period plays a bass drum, a question mark plays a quiro, an exclamation point plays a triangle, etc. This approach produces results not unlike Victor Borgas famous musical stories in which he expresses the punctuation marks as sound effects he makes with his voice. The effect produces audio perceptual segmenting of textual sentences.

2.3. Position Maps to Timbre

Letter position in a word is mapped to instrument used to play the letter's pitch. Fifteen instruments per synthesizer, all with unique timbres, were chosen to play positions one to fifteen. If a word contains more than fifteen letters, the assignments cycle over again. The five synthesizers used to produce the music provide a rich palette of sound. In this way, every word becomes either a unique melody, or a unique chord or set of chords due to the positional arrangements of timbres and tones. Even if a letter repeats in a word, it will not sound the same. The letters all play through MIDI channels 0-8, and 10-15. Channel 9 is reserved for the percussive punctuation marks.

2.4. Syllables and Words Become Chords

Textual information is presented in one of three ways - by letter, by syllable or by whole word. If played by letter, then a word becomes a melody (created by a certain and not too long of a delay between letters [3]). If played by syllable as shown in figure 2, then the letters in a syllable are stacked into a chord and played simultaneously. Every syllable will sound unique, because of the various timbres associated with position and pitch associated with letter code. If played by whole word, the entire word becomes a chord containing as many notes as letters in the word and played by as many as fifteen unique instruments. Every word results in a unique sound.

2.5. Generation of Rhythm and Timing

Timing in the sonification of text is allocated per word or per letter. Since every word is given the same amount of time for presentation, when they are presented by syllable, it causes rhythms to appear in the music. If a single syllable word is viewed as a quarter note, then a double syllalble word becomes two eighth notes. Three syllables become eighth note triplets and four syllables becomes 4 sixteenth notes. The end result is that the music becomes more interesting, rhythm is added as another aid to foster recognition, and very long words create a stimulating rush of chords.

DNA nucleic code were handled just like any other text file. A more elaborate sonification design could have been used to highlight hierarchical biological information but it would have clouded the punctuation mark information, and adde extra information that was not needed in this context (for more information on a more specialized design for DNA, listen to the DNA part of the sonification tour at www.quinnarts.com/srl).
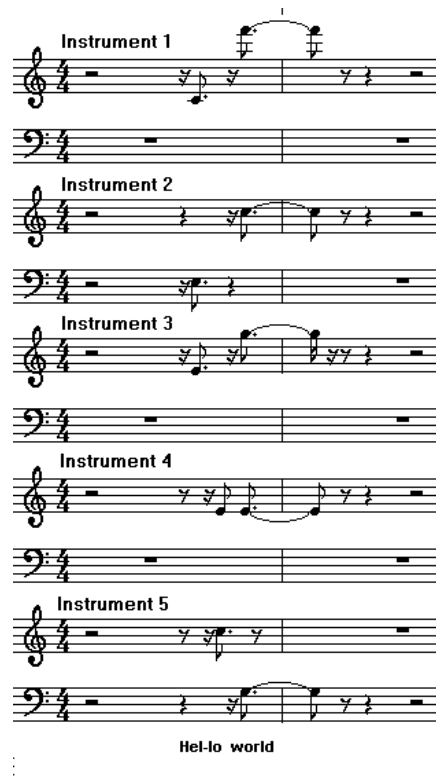

Figure 2. The words "Hello World" as music.

2.6. Description of the Textual Files

Nine text files were chosen to produce the music for the dance. The text files included the names of all those who perished on 9/11, the text of the US Constitution and some nucleic acid ACGT sequences of DNA obtained from the Human Genome Project. These three elements symbolically combine to (1) memorialize those who were lost (through their names), (2) convey an underlying theme of the oneness of humanity

(through our common yet diversely arranged DNA) and (3) acknowledge that we live physically through the code of DNA and in community through the code of the Constitution. The role of DNA has also proved critical in identifying persons.

The text files are also used to create the lighting for the piece. One data projector is used like a traditional follow spot, except that at critical moments, elements of the text scroll down Wendy during the dance. Another data projector is used to create an ambient effect featuring comments made by children about 9/11. These comments move, slowly spin and dissolve in a 3D space entirely covering the stage.

3. FLOW OF EVENTS

The name datasets were arranged to be played overtop of the DNA datasets, in the order coinciding with the events of 9/11. The US constitution would enter later, be played all the way through, and then the DNA would be the only remaining sound, which would then be faded out. A transposition control was available to transpose the sound of a dataset and was actioned periodically with various values up to 12 steps.
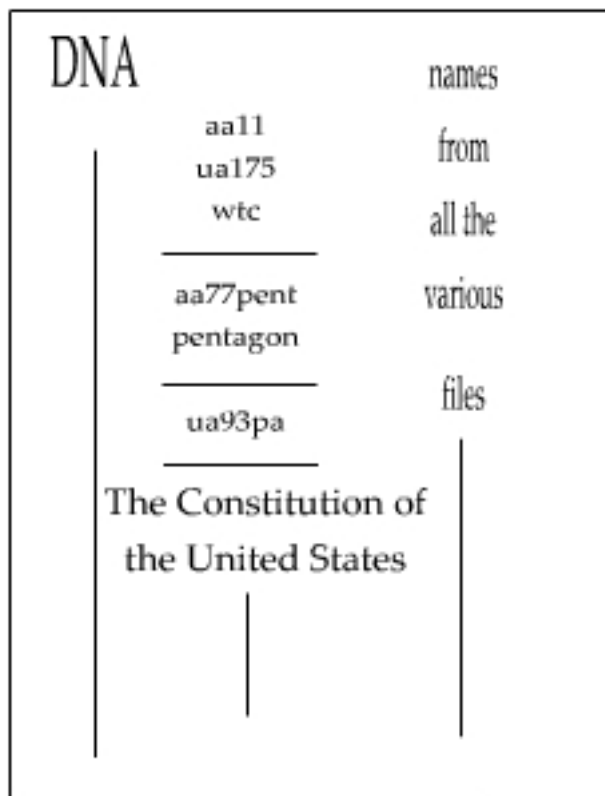

Figure 3. Flow of dataset sonification events.

During recording and after the general plan described above was accomplished, additional interesting effects began to emerge from continuing to play or transpose this or that dataset. This period, which was 13 minutes into the music, and after the original plan had been completed, was determined to be the most interesting section. It also contained three major sonic events, sounds that emerged from the transposition of punctuation marks contained in certain names.

The original plan of presenting the names associated with the events of 9/11 was then reworked to occur after the three special sonic events, and the decision was made to transpose each one up a number of steps when compared with the prior one. Each dataset was synthesized by a different 32 voice polyphonic QY70 or QY100 synthesizer and mixed into one of four stereo mixes to create a surround sound effect.

Figure 3 depicts the flow of events in the sonification. The music begins with DNA and a portion of the names of those who died. Punctuation marks in the names produce various percussion sounds. As the piece progresses, transposition is applied to the presentation of the name files. This caused the percussion sounds to be drastically changed resulting in surprising effects.

One minute and a half into the piece, three symbolic sonic events occur. These are analogous to the three major events of 9/11 (the strike of the twin towers, the strike of the Pentagon and the Pennsylvania crash). After each event, the names of those who died in each location, New York, Washington, and Pennsylvania are rapidly played at between fifteen and one hundred names a second. Shortly thereafter, the US Constitution begins to emerge as a cascade of sounds and is played in its entirety. Finally, the music ends simply with DNA, as a symbolic tribute to the fact that people from all over the world and of every background perished on 9/11, and to our common physical human heritage.

4. CONCLUSION

The comprehension of language is currently achieved through the visual perception of words, composed by combinations of shapes in particular orders, in conjunction with the aural perception of each word as a sound containing particular sequences of timbres and tones and presented at certain speeds in a flow of such aural events. By extending or restricting the presentation of language to certain sets of timbres, tones, rhythms and tempos in the musical domain, it seems plausible that musical cognitive pathways could be used to perceive and comprehend language.

It is hoped that the artistic aspects of the presentation should not obscure the work as an example of information fusion using multiple tracks of textual information. The 'purpose' of the resulting music was not to convey exact knowledge or perception of this or that name, but rather a general sense of the magnitude and gravity of the events of 9/11 through the perceptual buildup and gestault recognition of many individual events[3].

For Those Who Died is based on initial explorations by the authors that posed the question: Can textual sonification using musical encoding make reading by listening to music possible? In this case, it was not expected that anyone would be able to explicitly 'read' this sonification, but rather to come away with an experience of the events of that day with a new understanding and perspective. It can also be viewed as an example of extreme data fusion using musical encoding. A performance of the piece at the Pentagon is in the planning stage.

Design Rhythmics Sonification Research Lab will pursue a number of research topics arising out of this work. For instance,

given a choice of character to pitch mappings, which ones are preferred by listeners and why. How long would it take for a person or group to learn a 50 word vocabulary, and then how long to recognize new sentences built out of those fifty words. Finally, at what speeds could they comprehend the sentence compared with traditional and speed reading techniques.

5. REFERENCES

[1] J. Vento, "EOS Showcases Sun Research", Campus Journal University of New Hampshire, Vol XXXXII, Number 35, pp. 1, May 4, 2001. Refer to http://espg.sr.unh.edu/tof/Outreach for Solar Songs links.

[2] M. Quinn, L. D. Meeker, "RESEARCH SET TO MUSIC: THE CLIMATE SYMPHONY AND OTHER SONIFICATIONS OF ICE CORE, RADAR, DNA, SEISMIC AND SOLAR WIND DATA", ICAD 2001 Proceedings of the 7th International Conference on Auditory Display, Helsinki University. Espoo, Finland. 2001.

[3] Snyder, B., "Music and Memory: An Introduction", The MIT Press, Cambridge, MA, 2000

[4] D. Wolman, "Sound of Science", New Scientist, Reed Business Information, No. 2301 pp. 30-33, July 28, 2001.