Project Proposal

Course: USC Let the Data Speak

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"Space is only noise if you can see..." - Nicolas Jaar

Abstract.

In this project we will focus on representing the data gathered from nuclear launches in years 1945-1998 to create a meaningful audio message. We will be using 7 different variables from our dataset and various sonification techniques in order to accomplish this.
The final result should be informative (with clearly distinguishable countries of origin and purposes of the launch), as well as, in a way, touching, bringing emotional awareness of the presented problem in the listener.

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1. Background and motivation.

1.1. How the project started?

For the course “USC: Let the Data Speak” we were asked to create an audio representation of a statistical data by using any means of sonification. This project and a final exam will be counted towards our course grade.

1.2. How the group was chosen? / Story behind the project

While choosing our group members, we made sure that the members had a prior knowledge of either one or more of the following subjects: electronic music production, programming/coding, software or hardware engineering, as well as some musical knowledge and creativity. Our team started with only 2 people and an idea. It growed later as our friends, as passionate with this idea as us, joined the course.

1.3. Motivation.

As a start, all group members wanted to base the project on a dataset that would convey some sort of a pragmatic message after being sonified. The two ideas that first came up were either using the anonymous data from jPeople searches or using the history of nuclear launches. After brainstorming, a final decision of pursuing with the nuclear launches sonification was made by the group.

We really like this idea, because it allows us to unleash our creativity by creating the sound part of the project, and, at the same time, conduct an interesting research and present the data in still meaningful, but very different way. We expect people to think deeply about the problems of nuclear warfare and possible implications of it just by listening to amount and the variety of sounds in the our sonification of the dataset.

(Our member, Zuka, is a yle. А еще мы оставляем странные надписи на непонятных языках. Z.O.N.D. уже рядом!)

2. Research question.

Research Topic:
How well can sonification represent the data in a meaningful way? Can it add a dimension of emotionality to what seems to be just dry values?

When picking our dataset, we were looking for something that is original and has little presence in the media in addition to being something that has the ability to trigger emotions in the listener.

The two **main reasons** behind our choice of using the Nuclear Launches Dataset were:

1. The data is highly dimensional and there's a multitude of parameters to play with:

There is numerous datasets online about nuclear weapon testing and past nuclear combat incidents. Most sources have a multitude of different variables, tied to each datapoint, that can be used for this project, such as: name of the country, type, purpose, depth, yield, location etc.

2. Nuclear launches data carries a certain amount of emotional connotation and therefor answers directly to our needs:

Since nuclear weaponry is something that leaves little to no one cold hearted it's a perfect dataset for evaluating the emotional response. the conveyed emotions of course depend largely on the choice of sounds but we hope that the sheer amount of data points and the intensity will serve our purpose well.

To further test the emotional subtext of the result, we will attempt to get several subjects to listen to the final track with and without prior knowledge of the data source.

3. Methodological approach.

3.1. Data sources.

http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/31/060/31060372.pdf
This is a list of all officially announced nuclear tests and combat explosions. It covers the span of 1945-1998. It was originally compiled from the official nuclear detonation data released at various time by the USA, Russian and French officials. This listing includes all listed detonations carried out by United States, the Soviet Union, the United Kingdom, France, China, India and Pakistan

3.2. Data characteristics.

The data we are using as our source gives us a lot of freedom as it's very thorough and has a lot different variables. First of all the list we're using has more than 1500 entries. each of the nodes is characterized by 16 variables, however some of them we've deemed not as meaningful as others and some of the variables are easier to treat in a combined manner. All in all we will most probably be using the following as the modifying variables:

- Time of detonation

- The country of origin
- Location of the detonation
- The depth at which the detonation occurred
- The purpose of detonation
- The type of deployment
- Power of explosion

Unfortunately the data is not present in full i.e. some of the values are missing. The workaround we're proposing is to set the missing values to a certain meaningful default, something that will sound right.

3.3. Speciality of selected data.

The data that we selected directly corresponds to the goal we set for ourselves. It describes the occurrences of nuclear detonations with great precision. It's also an interesting piece of information, as data like this has to go through a lot of scrutiny until its officially released into public. One of the consequences of this is that it's extremely hard to obtain up to date information, because it might still be strategically important. Additionally what is interesting and even alarming to a certain extent is the actual number of explosions. The interest arises from the fact that most major pages of history only focus on the Hiroshima/Nagasaki incidents and perhaps early tests. So this data is also interesting in demonstrating the whole extent of the history of nuclear detonations.

3.4. Musical mapping.

(This is the very brief estimation - mapping may experience changes in the process, upon some tries. We understand that the undertaking we have in mind is quite complicated, but we believe that the end justifies the means. Therefore we can vary from the original plan to bring the best final experience.)

Date / time of the launch:

Date of the launch will be mapped to the time of the sound in the track, on the scale from the first launches in 1945 and until 1998. In our preliminary idea, should the sonification itself work out nicely, we want to make a playback control interface with possibility to pause, increase or decrease speed and go to a custom date in the defined range.

Geographical coordinates:

The geographical coordinates will determine the pan i.e. which speaker the sound iscomingg from. we will vary the coefficients for the speakers based on the deviation from the mean point of all detonations.

Power of Explosion:

The power of the explosion will either modify Reverb, Delay, Volume two at once or all three together. Subject to change.

Country:
Origin (in other words, launcher) of the bomb defines a musical instrument, that will be played. We didn't define the exact mapping yet, but here is one of the potential options:

- USA - Drums
- Soviet Union - Analog bass
- UK - Synth #1
- France - Synth #2
- China - Bells
- India - Ukulele
- Pakistan - Harmonica

Depth:
Depth estimates show, in kilometres, how deep in the ground the explosions were conducted. (Some height estimates are also given to indicate the altitude at which atmospheric tests were conducted. A positive figure indicates depth, a negative figure indicates height.)
In our project, depth will adjust hi/lo pass filter.

Purpose:
Purpose of the detonation will define an octave, in which sound will be played.
There will be 9 different purposes, bundled in the groups of 3, specified below:

Combat-related (high pitch):
- **COMBAT** - The two atomic bombs dropped over Hiroshima and Nagasaki in August 1945.
- **WR** - Weapons-related, i.e. related to the weapon development programme. (N.B. If no information on the purpose of a test is available WR is given in the table.)
- **ME** - Test conducted in the context of a military exercise with a real nuclear detonation. One such test (Soviet) was conducted, in 1954.

Transportation and research (somewhere in between):
- **FMS** – Soviet bombs used for studying the phenomena of nuclear explosions.
- **TRANSP** –Transportation-storage purposes; Four US tests conducted at Nellis Air Force Range in 1963.
- **WE** – Used to evaluate the effects of a nuclear detonation on various targets.

Safety-related (low pitch):
- **PNE** - “Peaceful nuclear explosion”.
- **SAM** - Tests to study accidental modes and emergencies (Soviet Union).
- **SE** - Tests to determine the safety of nuclear weapons in case of accidents (France/US).

Type:

In our dataset, we have roughly 12 different values:

- **BALLOON** - Device was dropped from a balloon
- **AIRDROP** - Device was dropped from an aircraft
- **ROCKET** - Launched by a rocket
- **TOWER** - Mounted at the top of a steel or wooden tower
- **BARGE** - Placed on a boat
- **WATERSURFACE** - On the surface of the sea
- **SURFACE** - On the ground close to the earth's surface
- **CRATER** - In a crater
- **UW** - Under water (few nuclear tests)
- **SHAFT** - Vertical drill hole
- **TUNNEL/GALLERY** - Horizontal drill hole

We will use these values to pick the musical note to be played for the respective data point.

3.5. Sonification tools to be used.

All of the group members share an idea, that sonifying information to produce a meaningful sound is a very personal and creative process. Therefore, we think it's unfair to limit ourselves to the features of existing sonification solutions.
We decided to write our own application in Processing language, known for its great potential for the purposes of art. We will use Beads library[1] for generating and filtering samples, recorded using Ableton exclusively for the purpose of this project.

4. Expected results, patterns and claims.

This project will result in a musical representation of our data set: nuclear bomb explosion statistics over time and geographical locations. We will present it as a standalone musical piece (hopefully sounding organic), but we will try to provide some visualization for it as well.
Since there's a limited number of countries with access to nuclear technology the resulting track might have a certain monotonicity to it, however we will try to remedy this by utilizing other variables as various filters/modifiers. In addition, the amount of detonations, and countries of origin increases significantly with the passage of time so we expect the musical piece to start slowly and more monotonously but later reach a much faster and overwhelming pace.

5. Expected value of sonification.

The size of the dataset and a considerable amount of data characteristics allow us to convey the information in a very great detail through the process of sonification. Track will start shortly before the first launches in 1945 and will chronologically progress all the way to 1998, the last tests recorded in our dataset. Variety of launch purposes, geographical coordinates, power of

explosion etc. will help us to create a whole range of musical instruments and different sound qualities.

While listening to the final result, person should clearly distinguish different tests according to their characteristics. It's of the prior importance to us - to display a complete dataset in the form of a complete musical composition, while still presenting the informative side of the dataset. In our opinion, those 2 qualities combined are the main value of this project.

6. Project plan.

Mar 18 - Apr 1: Phase I. Preparation.

Team A:

* Gather information from .pdf file to machine-readable format.
* Develop a tool in Processing (Java) to parse and process the data.

Team B:

* Record needed samples from the various instruments in Ableton.

Apr 1 - Apr 15: Phase II. Implementation.

Team A:

Design an algorithm, that:

* Sorts and extracts the needed information from the dataset.
* Assigns handlers for the different data characteristics.
* Creates the corresponding wave/sound players and filters.

Team B:

* Determine all the settings, needed for the sound effects.
* Determine the key, BPM and other properties of the composition.
* Attempt to manually mix the recorded samples to estimate the final sound.

Apr 15 - May 1: Phase III. Wrap-up.

Team A:

* Finalize the audio setup.
* Perform few test-runs, until the best sound is achieved.
* Export the final result and optimize it in audio processing software.

Team B: *(should we have remaining time)*

* Create the user interface to control the playback.
* Create the visualization for the exported audio track.

7. Preliminary bibliography.

[1] Sonifying Processing: The Beads Tutorial
http://www.computermusicblog.com/SonifyingProcessing/Sonifying_Processing_The_Beads_Tutorial.pdf

[2] Nuclear Explosions 1945-1998
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[4] Music visualisation using Processing.
https://www.cg.tuwien.ac.at/courses/Seminar/WS2010/processing.pdf