SYSSON - A SYSTEMATIC PROCEDURE TO DEVELOP SONIFICATIONS

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ABSTRACT

The newly started research project SysSon (http://sysson.kug.ac.at) will develop a systematic procedure to develop sonifications, and test the procedure with climate data. The SysSon approach addresses the relevant obstacles that are met when introducing sonification in a new scientific domain: the cultural bias, usability and technical issues. This paper presents the research approach and puts it up for discussion.

1. INTRODUCTION

Usual obstacles to the application of sonification in science have been cited, e.g. [1]. These include, amongst others, 1) a cultural bias, i.e. a listening comprehension barrier, as there are few traditions of using sound to do science and practically no training in it; 2) quality control and questions of usability; 3) working premises, i.e. a technical barrier, e.g., created by the fact that audio software is not compatible with data in the domain sciences. In SysSon, we want to address all these factors explicitly:

- The cultural bias is usually the strongest barrier. Therefore we will adjust the sound design explicitly to cultural metaphors of the domain science. Furthermore, a common terminology will be built up accompanying a sound library, which shall allow communicating about the sounds. The additional gain of the sonification approach will be pointed out by comparing it with advanced visualization in the domain.
- Quality control and usability need to be assured by vigorous evaluation. The project includes therefore several evaluation steps of the sonification design within different test groups. Furthermore, a public media installation and an expert workshop will be used to evaluate the project's results.
- The technical barrier can be treated by providing an independent, easy-to-use sonification tool at the end of the project, which is adjusted to software and data formats that are common in the domain science.

We will develop a systematic procedure taking these factors into account and elaborate sonifications for complex, dynamic data, as can be found in various fields. In the project, we chose climate data as an ideal case study. Climate data provide a good, practicable working basis, as both model data and measurement data are at hand, and they provide a straightforward real-world interpretation. The data sets are high dimensional and large. Furthermore, there is consensus on global climate change and the necessity of intensified climate research today in the scientific community and general public.

2. RESEARCH APPROACH

The research approach is based on our experience from previous projects (www.sonenvir.at, www.qcd-audio.at) and on a variety of knowledge of the ICAD community, of which not all projects can be cited here. SysSon is the systematic development and evaluation of a sonification design for the example case of climate data. It proposes a procedure for developing sonifications that are well integrated into the specific scientific community. The systematic sonification procedure of SysSon encompasses several steps:

Preparatory steps: As preparatory steps, the data has to be prepared, and a short update of the literature survey on current sonification strategies in the domain science field has to be conducted. Furthermore, the needs of the domain scientists have to be analyzed and existing visualization tools assessed according to their capabilities.

- Data preparation and literature survey
- Evaluation of existing visulization tools
- Analysis of domain scientists' needs

Interdisciplinary communication: In a second step, the interdisciplinary communication has to be built up between the specific language and metaphors of the domain scientists, and the one of the sonification designers. An extended TaDa (Task and Data analysis [2]) can be used for this part of the procedure. The metaphoric sonification methods [3] will be used to explore (implicit and explicit) audio and other metaphors of the domain scientists. With this knowledge, and based on our experience, a first library of sounds shall be established, which serves as a working basis for the sonification design. Once a sonification design has been developed (based on the evaluation cycles as described below), a final sound library and terminology can be assembled. The library serves as a key for the sonification (in analogy to the key of a graph), and facilitates a joint terminology of domain scientists and sonification designers. Sound phenomena in the sonification can be verbally described, understood, and, thus, better recognized and discussed.

- Analysis of domain scientists' metaphors
- Establishment of sound library

Sonification Design: The development of the sonification design is an iterative process based on the study of the domain metaphors. It comprises the choice of (a/) basic sonification method/s, the possibilities of user interaction, and the set of parameters, which are adjusted to the data.

- Development of sonification model
- Implementation of sonification

Evaluation: The sonification design is driven by a cyclic evaluation process. We propose three different test groups; the domain scientists as experts on the one hand, and non-experts, but aesthetically trained people - musicologists and sound engineers/ computer musicians - on the other hand. The domain scientists can use the sonification prototypes for exploration tasks and evaluate the scientific gain of the representation. The second and third group are responsible for an aesthetic evaluation, assuring that the sounds will not become annoying even when working long time with them. This group will also conduct simple exploration tasks. Open floor is given to a general public, who will give indirect feedback on the sonification in a media installation. Finally, sonification experts will discuss the project's theoretical outcome and the specific sonification design in a concluding workshop.

- Cyclic sound evaluation by three test groups
- Public and expert evaluation

Dissemination: Sound shall be used as a new means to display scientific data, but as an innovative medium also further spread the information to a general public, e.g., in a media installation. As deliverable, the sonification design has to be brought to a profound technical shape, which can be easily used by the domain scientists to work with.

3. CASE STUDY

A systematic sonification approach cannot be developed per se, but needs a meaningful case study of data. We chose climate data which is provided by the Wegener Center for Climate and Global Change (WegC, www.wegcenter.at). First results of the preparatory steps are shortly presented below.

3.1. Evaluation of existing visualization tools

Many challenges of sonification of a given data set are also found in visualization - the innovative data exploration software SimVis [4] (www.simvis.at, see Fig.1) has partly been developed in cooperation with the WegC. Other software used at WegC include IDL (Interactive Data Language, www.exelisvis.com) and the open source language R. We assess the use and functionality of these and other tools during the initial user interviews (see below).

3.2. Analysis of climate scientists' needs and metaphors

Eighteen members of the staff of WegC have been interviewed by a moderator and observed by a second interviewer, and were audio recorded. General questions assessed their qualification, the use and usability of their tools of data analysis and visualization, their user goals with these tools (incl. task success, efficiency, and learnability), and expectations for the sonification. The central part of the interview consisted of a self-chosen typical task that they walked us through, starting from raw data, where they have recently gained some insight during an analysis process. In a second step, the results from this task were presented in a 'group meeting', allowing us to study the communication in-between an expert focus group, thus assessing the typical language and metaphors of the field.

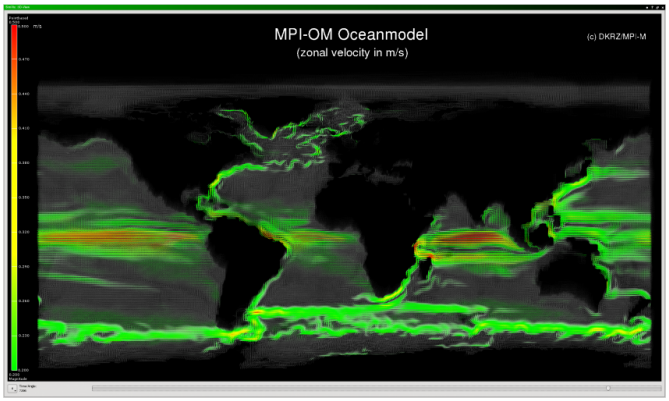

Figure 1: Visual analysis of ocean currents using SimVis, http://www.simvis.at/references/showcase (accessed 16/02/2012).

The analysis of the interviews is ongoing. It will comprise (a) a listing and research of data analysis tools, (b) the inquiry of a typical workflow in climate data analysis, (c) a language investigation of the transcribed interviews and focus group meetings. Furthermore, the acceptance of learning and using a new tool is quested, which shall also be indirectly raised by engaging the researchers from the beginning into the design process. The participants were rewarded with headphones to thank for their collaboration, and to further engage them with audio, e.g., by regularly sending them links of sound material resulting from the project as disseminated at http://soundcloud.com/syssonproject.

4. CONCLUSION

This extended abstract gives a quick overview over the planned systematics that will be further developed and tested in the research project SysSon, which has started in February 2012. Due to the shortness of this format, we cannot go into details with the planned sonification design and technical implementations, but rather want to stimulate a debate on the suggested research approach and the test design of the preparatory tests at WegC.

5. REFERENCES

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