SYSSON - A SYSTEMATIC PROCEDURE TO DEVELOP SONIFICATIONS

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ABSTRACT
The newly started research project SysSon 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 that shall be put up for discussion. Furthermore, first results of the preparatory steps will be presented.

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 within different test groups. 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.
- 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
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
- Analysis of domain scientists’ needs
- Assessment of existing visualization tools

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— needs
- 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 or a mix of methods, the possibilities of user interaction, and the set of parameters, which are adjusted to the data.
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 is 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. Thus the cyclic evaluation shall ensure the sonification’s ability to display structures and patterns in the data while taking into account its metaphoric content and the aesthetics of the sound.

Dissemination: The dissemination is important for the projects success. 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. 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. Furthermore, a media installation or similar outreach event can be organized for the general public.

3. CASE STUDY

A systematic sonification approach cannot be developed per se, but needs a meaningful case study of data. Climate data is an ideal test case for our purposes, as the data sets are large and high-dimensional, highly dynamic, and still describe simple measures. The societal impact is very high, thus sound can be used to communicate about climate phenomena and climate change.

At ICAD, first results of the preparatory steps shall be presented, mainly the analysis of visualization tools and climate scientists’ needs.

3.1. Analysis of visualization tools

A first visual screening of the data will be done with the innovative data exploration software SimVis (e.g., [4]) developed at SimVis GmbH, Vienna, Austria. A showcase of the visualization of ocean currents is given in Fig. 1. This software has been extended and enhanced for application to different climate data sets. Successful exploration of radio occultation observations and climate model data was performed, see [5, 6]. We will compare the visualization strategies of SimVis to find acoustic equivalents and/or decide on a complementary approach in which sound reveals additional information on data shown in SimVis.

3.2. Analysis of climate scientists’ metaphors

In qualitative and partly quantitative interviews, we will extract metaphors that climate scientists use. Also a needs’ assessment will be conducted, providing information on where sonification could be most helpful in the field, and would thus be welcomed.

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. We want to stimulate a debate and question the community on the suggested research approach. For ICAD, also first results from the interviews with climate researchers will be at hand.

5. REFERENCES