FP6-NEST-PATH projet no: 29085

Closing the Loop of Sound Evaluation and Design (CLOSED)

Publishable Short Project Presentation

September, the 30^{th}

1 Background

The sounds of designed objects have long been thought of as at best unnecessary, and at worst sources of nuisance. While acoustic annoyances remain a significant problem, ideas in sound design are evolving to address broader notions associated to quality, functionality, interaction, and aesthetics. Consider for instance an electric orange juicer (Figure 1). Its sound implicitly informs you about the speed of the motor, the resistance of the flesh of the fruit, and these guide the pressure you exert with your hand against the orange. Sound also communicates how well-crafted the device is, and contributes to its brand image. If the sound is too shrill, it may upset you, or deter you from using or buying it. This simple example illustrates why sounds are now considered to be an important determinant for the overall quality of products, and, at the same time, how the design of product sound is intimately tied up with function, aesthetics, and emotional reaction. The very expression "sound design" has emerged comparatively recently, having been borrowed from the realm of visual design. But despite being a promising and lively playground, sound design is not a discipline as solid and established as visual or industrial design. Indeed, the revolutionary contribution of the Bauhaus school in the early 20^{th} century was to situate visual art in an iterative process, incorporating analysis and prototyping. The word "design" implies an iterative loop which compares the quality of a prototype with pre-defined specifications, and which analyses and refines the prototype until those specifications may be adequately met (see Figure 2). What is missing in the discipline of sound design are the required knowledge, measurement tools, and methods so as to allow to compare the sonic appearance and interactions of an artifact with its specification in relation to its users. The aim of the CLOSED project is to provide such concepts and tools, toward closing the loop of sound evaluation and design.

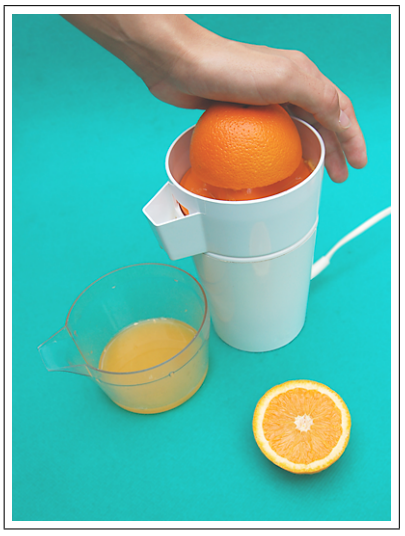


Figure 1: Sound may guide the interaction between user and everyday appliances, like the juicer. But it is also intimately tied up with aesthetics and the user's emotional response to the product

2 Objectives

The CLOSED project is being conducted within the sixth European Framework Programme (FP6) New and Emerging Science and Technology initiative *Measuring the Impossible*, with the aim of giving an impulse to fundamental advances in future measurement methods and techniques. It relies upon a strong collaboration between four research areas: physically-based sound modelling, interaction design, psychology of perception and cognition, and signal processing and machine learning. The overall objective of this consortium is to provide a tool for sound designers to assess qualities of function and aesthetics. On one side, this tool will be linked with the physical attributes of sound-enhanced objects. On the other, it will be related to the subjective responses that are elicited during the course of interaction with them. To make this possible, this objective is divided into four deeply interacting research paths, corresponding to the core skills of the partners that form the CLOSED consortium:

- Based on modelling of physical phenomena, the project will provide sound synthesis modules linked to the perceived characteristics of basic sound events.
- Based on interaction design research, the project will single out basic *interaction primitives*, create prototypes artifacts to illustrate them, and innovate a methodology for the design of sonically enhanced interactive objects.
- Based on psychological experiments, the project will provide a model of the perception of everyday sounds, relating function, aesthetics, and emotion to the basic characteristics of sound events.

- Using machine learning techniques, the project will create measurement tools which automatically extract basic sound event characteristics and relate them to function, aesthetics and emotions.

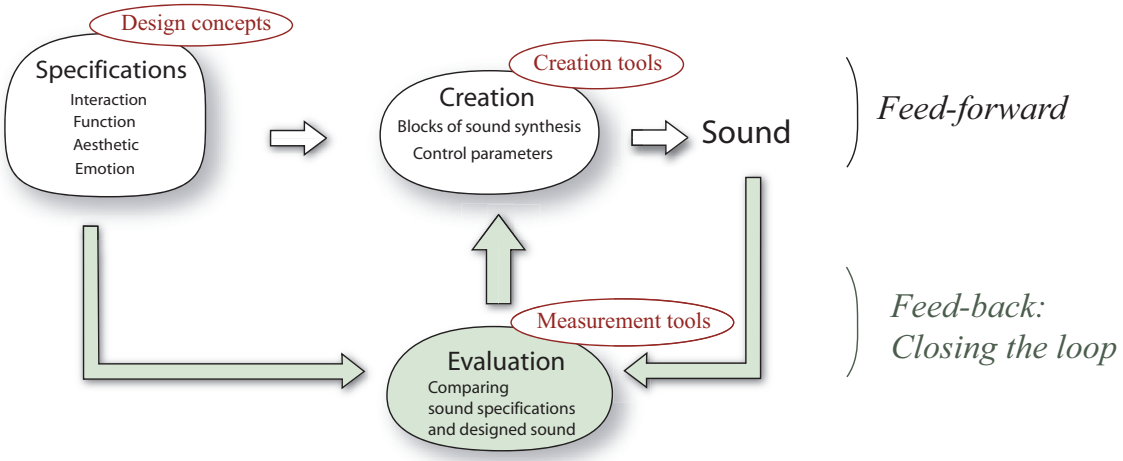


Figure 2: Design involves both feed-forward and a feed-back processes. The goal of the CLOSED project is to provide tools and concepts that will allow to close the loop of sound evaluation and design.

3 Work programme

The CLOSED project involves a deep interaction between the four objectives. This interaction is illustrated in the work programme depicted in Figure 3.

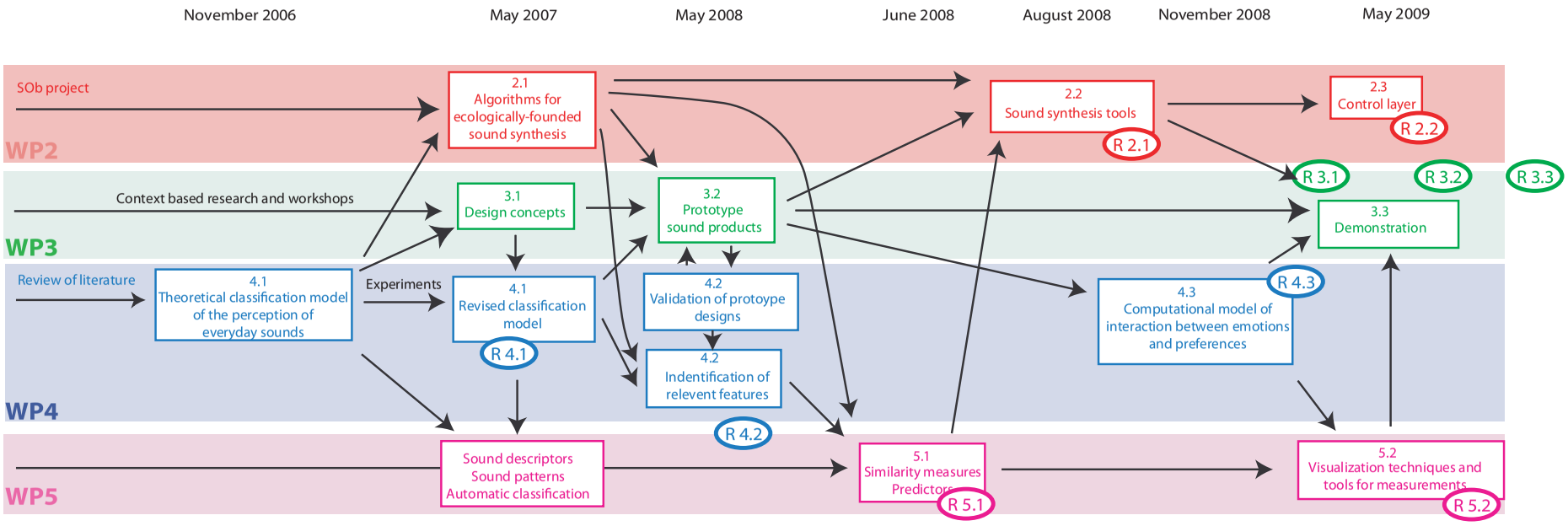
4 State of progress

At the end of month three, the CLOSED consortium has established the instruments that will enable the project to work properly: a *pre kick-off meeting* was held in July and has initiated the discussions on the basis of the presentation of the pre-existing knowledge of each partner. The *kick-off meeting* was held in early September in Berlin. It allowed to present each work package and its connection with the others in a more precise way as well as to present some very simple preliminary results and demos. During the meeting, several fruitful discussions took place as well as a brainstorming session.

The internal *wiki page* of the consortium has been built, and is now an active forum for discussion. In the meantime, each research line is currently attending to its specific objectives. The consortium is extending the sound synthesis tools that were developed in a previous project, is conducting context-based design research in a workshop setting, is reviewing the literature on everyday sound perception and cognition, and, finally, is applying machine learning techniques to data from simple perceptual experiments.

5 Publication and other dissemination routes

The consortium presented the CLOSED project during the 2^{nd} ISCA/DEGA workshop on the Perceptual Quality of Systems in early September in Berlin, to a community of researchers interested in the measurement of perceived acoustic quality. It was an occasion to note that the goals of the CLOSED project meet tightly the issues with which the community is very concerned: function, emotion and context.



Results

R 2.1 Set of sound synthesis algorithms
R 2.2 Sound design building blocks
R 3.1 Scenario and concept developments
R 3.2 Sound product prototypes
R 3.3 Functional-aesthetic based sound design process

R 4.1 Theoretical classification of everyday sounds
R 4.2 Identficaiton of the sound features/patterns
R 4.3 Model relating function/aesthetics and emotion
R 5.1Prediction of sound features/patterns
R 5.2 Visualization of sound patterns

Figure 3: Work programme for the CLOSED project