SPARG Composing and Capturing 3-d Soundscapes

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Introduction

Dr Peter Lennox and members of the Signal Processing and Applications Research Group (SPARG) developed a project that involves students in research-based learning, based around a TIR-funded project to assemble Very Large Artificial Soundscapes.

> *"The key ingredient in this project is the attempt to motivate students to take the initiative in 'research-based learning'. That is, beyond the requisites for performance within the taught modules via assigned work, students are encouraged to pursue knowledge for its own sake. The aim is to focus students' attention on the project at hand, rather than on the teaching-and-learning process. The primary aim is to engender creativity when thinking about technical, perceptual and artistic problems."*

Objects of evaluation

1. Does the use of practical exemplars help to 'make sense' of abstract theory?
2. Is the balance of *appropriate* (sometimes competing) theories more apparent when theories are physically explored?
3. Is creativity within a technological context *improved* by combining theoretical and practical exploration?
4. Does taking an exploratory approach complement more traditional, prescribed (taught) methods?

A cohort of <50 final year BSc students within the Electronics and Sound subject area of the School of Technology were given access to proprietary hardware/software solutions (developed within the School) to enable them to capture and manipulate large natural sound fields. Their task was to develop novel and innovative solutions to uncommon spatial sound problems.

Perceptual veridicality

The design criteria included paying close attention to perceptual veridicality for sources and environment-features in terms of size, orientation, direction and distance, for the majority of possible perceiver positions. A further test was that perceivers were to be encouraged to explore, walking around inside and outside the displayed sound field. The results were then auditioned in suitable large-scale venues, giving the students opportunity to evaluate and fine-tune the results.

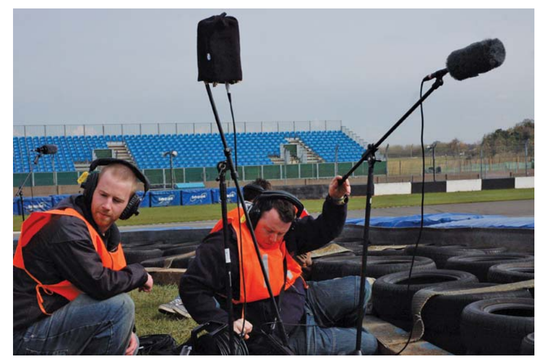
"Stunningly realistic…that Ferrari nearly ran over my toes as it left the track"

Results

The results showed that it is theoretically possible to mount very large *navigable* sound fields and that the principles are (unlike domestic technologies) upwardly scalable to an unknown limit. The students had no technical precedents to follow, and developed their solutions empirically through 'trial and error' methods. They subsequently theoretically analysed the psychoacoustic results.

Example 1: A Formula One race track

Example 1 involved recording a segment of Castle Donington motor racing track, using an array of Soundfield™ and 10 hypercardioid microphones. The signals, time-aligned and spatially scaled down in a 10:1 ratio (so 800m was depicted as 80m), were depicted using 16 loudspeakers.



Example 2: The bowling alley

One-to-one mapping of a 'line event'

A lane of a 10-pin bowling alley in use. Twenty speakers were used to display the virtual bowling lane in a corridor. Visitors (randomly positioned along the corridor) were encouraged to point at the ball as it progressed (which they did with great accuracy) and to anticipate the crash into the virtual skittles (which they also did). An unintended result was that visitors tended to *subconsciously* move out of the path of the heard object.

Feedback

Students indicated that classroom-taught theory 'came alive' and gained relevance. All students involved 'put in extra hours' to achieve what they wanted, indicating that this was irrespective of assignment grades. They were especially pleased to have devised something *new*, beyond what is technically feasible in existing commercial technologies. Some students, on their own initiative (having completed their course), continue development of these ideas and have indicated their wish to return to explain their projects to next year's cohort. Several have agreed to demonstrate their projects at the final spACE-Net international workshop to be hosted at the University of Derby in September 08.

Benefits for students

- Theory made real: made *meaningful*
- Students can go *beyond* current theory

Benefits for staff

- Away from the boring classroom, the subject (and the student) comes alive!

Benefits for University

- Students produce *interesting* and *relevant* demonstration material – some of which has featured in national press