Towards a Browser-Based Ear Trainer

Using web technologies for cross-platform, effective delivery of ongoing ear training for sound engineers

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Technical Ear Training

Aims

Four principle training objectives are drawn from reviewing literature and existing solutions:

- Increase hearing acuity
- Cultivate a reliable, conventional 'internal reference' or 'timbre memory'
- Develop an understanding of the relationship between acoustic properties and auditory impression
- Promote the use of qualitative language

Topics

Existing curricula and relevant literature suggest six core areas of study for a technical ear training course:

- Spectral qualities
- Loudness
- Distortions and noises
- Spatial qualities
- Reverberation
- Dynamics

Exercises

Following review of existing solutions, a three-dimensional scale is proposed which can be used to group similar task styles and properties:
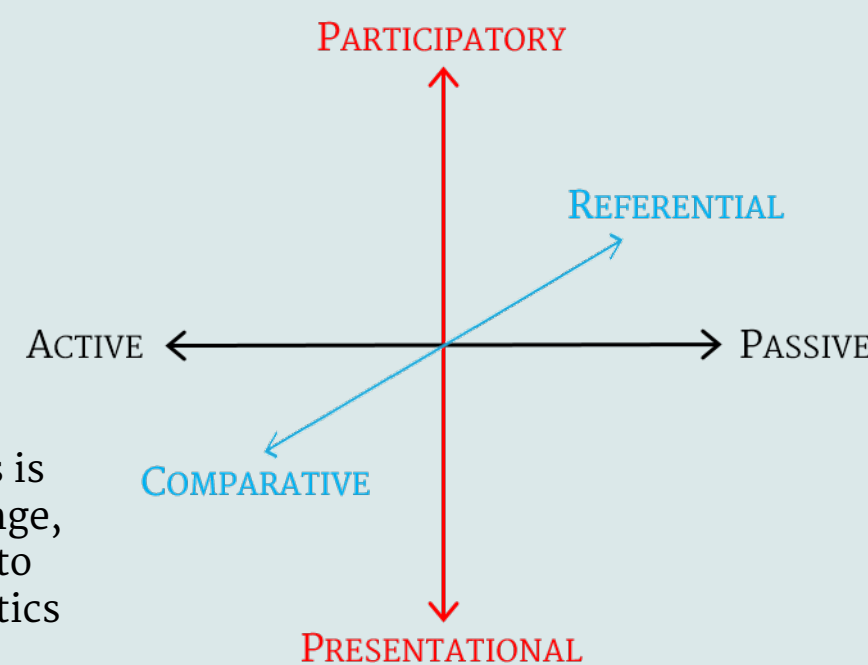
Student progression and motivation

Methods of managing progression through the course and personalising exercise difficulty are examined. It is found that programmes that incoroporate game features enhance student motivation for greater attention to and retention of content.

A model of instructional games is examined. Rules, goals, challenge, mystery and control are found to be important game characteristics to incorporate in ear training.

Software-based Ear Training

Why use software?

Innovative use has been made of computers in assisting technical ear training. Using a software-based solution for technical ear training offers a number of benefits, including instruction that can be easily customised to the needs of the individual, constant and objective assessment, and the opportunity for a student to practice more regularly than they could with an instructor.

The use of software also allows new types of training exercise: for example, Corey (2007) suggests tasks derived from Digital Audio Editing techniques (below).
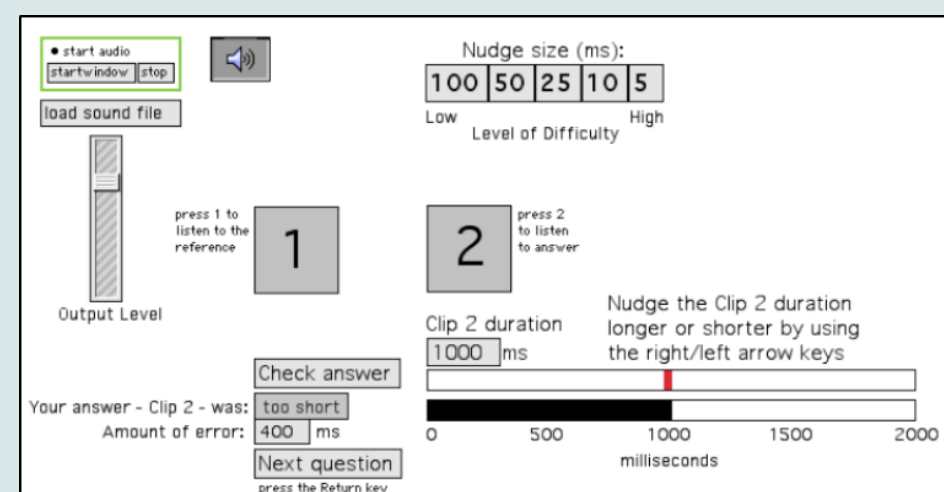
Why use the browser?

While successful software-based technical ear training programmes are already in use, recent developments in web technologies provide unprecedented opportunities for an improved training solution that could run entirely in the web browser using no third-party plugins. Applications written in JavaScript and designed to run in the browser can offer cross-platform compatibility extending to mobile devices, and longevity through standardisation, both of which provide the ideal basis for building a browser-based solution that can boast wide support for the technologies it uses and unmatched accessibility to the user.

Web Audio technologies

Until recently, cross-browser functionality for web audio has been delivered through plugins such as Adobe Flash and Apple Quicktime players. However, over the last decade, there have been substantial advances made in native audio support in web browsers, with the introduction of HTML5 and the Web Audio API.

The Web Audio API is a high-level JavaScript API providing tools for audio processing and synthesis, including oscillators, compression, filtering and panning. Browser support is improving rapidly, with standard support in Firefox, Chrome (incl. Android), Safari (incl. iOS), Opera, and soon in Microsoft Edge.

Proposed solution: orientEar

A browser-based solution is devised which improve upon existing solutions by embracing new web technologies. The principle aims are to:

- Use a sound curriculum based on a combination of successful existing solutions and more innovative research and suggestions of Corey and Haigh.
- Improve upon 'native' software-based solutions by enhancing cross-platform support and development, and extending support to mobile platforms.
- Incorporate game characteristics to enhance student motivation, including the opportunity for real-time manipulation of audio, and competition (whether against the computer or against other students through rankings or multiplayer elements)
- Be delivered entirely using browser-native technologies, for example: Web Audio API, WebRTC, HTML5/Canvas

Development

A specification for the curriculum and software implementation of the orientEar solution was assembled. Existing open-source projects were selected for inclusion in the solution, principally: *Bootstrap* and *UserFrosting* frameworks for user management and front-end, the *Aurora.js* codec framework and the *flac.js* decoder to deliver a library of lossless-coded audio with minimal bandwidth, and *wavesurfer.js* for waveform visualisation and audio playback.

A proof-of-concept phase of development was completed for the project, with further development intended in the near future. The Web Audio API (adhering to the current iteration of the developing W3C standard) was used for all audio manipulation.

Designed for cross-platform compatability, the proof-of-concept software implementation of orientEar can be seen running in Chrome for Android (right).
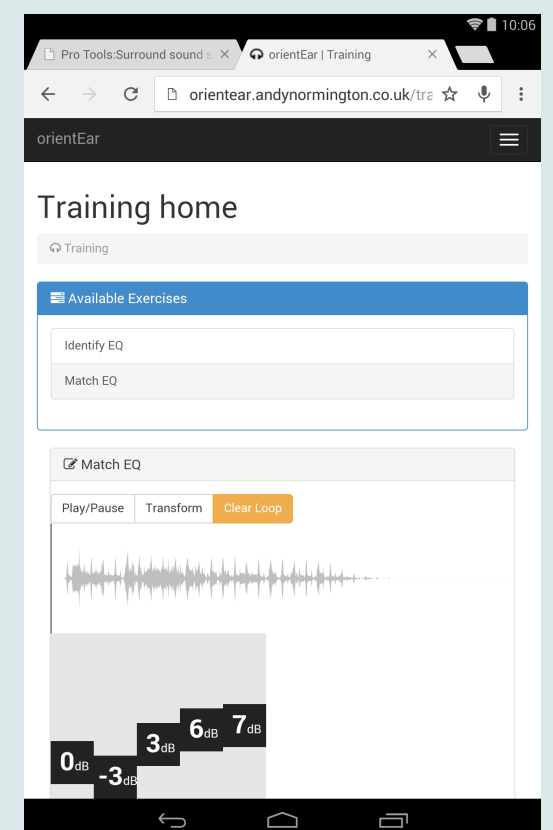
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