TEMPORAL VARIATION IN AMPLITUDE ENVELOPE AND SPECTRAL CONTENT IMPROVES DETECTABILITY IN AUDITORY INTERFACES

Liam Foley[1]*, Joseph Schlesinger*[2]*, and Michael Schutz*[1]

[1]McMaster University, Canada
[2]Vanderbilt University, Medical Center, USA
foleyt@mcmaster.ca, joe.schlesinger@gmail.com,
schutz@mcmaster.ca

ABSTRACT

Auditory alerts are important tools in human-computer-interface design. However, there are numerous documented problems with detectability and annoyance. Although human factors researchers are exploring many approaches to improving alarm efficacy, surprisingly little attention has been paid to the quality of the alert sounds themselves.

Here we explore the effect of manipulating an alert's overall amplitude and harmonic content on both (a) detectability and (b) annoyance. We synthesized tones with four harmonics at four durations relative to the length of the fundamental (100%, 50%, 25%, 10%, 5%). Each harmonic condition had a flat amplitude envelope (no temporal variation), and a percussive version (exponentially decaying amplitude). Participants completed a detection task, indicating when the tone was present amongst noisy speaker babble, followed by an annoyance rating task.

We found a main effect of envelope, indicating better detection of percussive tones—particularly at lower volume levels. Interestingly, although the percentage of harmonics had minimal affect on detection, it strongly affected ratings of annoyance. This apparent disconnect between annoyance and detectability suggests a promising path to decreasing alert annoyance without sacrificing detectability. Specifically, percussive sounds with short "splashes" of harmonics could prove superior to industry standard sounds in a wide variety of auditory interfaces.