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Exploring the use of structured musical stimuli to communicate simple diagrams: the role of context

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Abstract

The results from previous experiments using structured musical stimuli to communicate coordinate locations within a graphical grid, navigation of an auditory cursor and simple shapes are used as a basis for further exploratory research to communicate diagrams. An experimental framework program (called AudioGraph) provided a platform for investigating musical information processing for blind users. Under this platform, simple arrangements of shapes (forming diagrams) were communicated to users using structured musical stimuli. Meaningfully arranged graphical shapes (at least for the visual sense) were communicated in the absence, and in the presence of a particular perceptual context or different perceptual contexts. The results indicated that perceptual context played an important role in the interpretation of the structured musical stimuli that communicated simple diagrams. The paper concludes with a discussion on the implications of the results, the role of context and the use of structured musical stimuli to communicate graphical information to visually impaired users.
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Keywords: User interfaces; Earcons; Structured musical stimuli; Communication metaphors; Graphics; Music; Auditory channel

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1. Introduction

The auditory channel has been somewhat neglected in the area of user interface design. This is despite the fact that auditory interaction is one of the primary forms of human interaction. Structured musical stimuli is one of the richest channels of auditory communication and has a number of useful properties such as pitch, rhythm and melody that could convey information from software components to the user. Structured musical stimuli, like other forms of audio channels, has a number of advantages over the visual channel. For example, a user need not be attending to the screen when an auditory event occurs. Furthermore, the visual channels are becoming very crowded as designers try to present more information visually. Finally, auditory communication offers a way of communicating with visually impaired users.

In previous work (Rigas and Alty, 2005), the possibilities afforded by music for conveying simple graphical information were explored. Users were able to make qualitative judgements when presented with structure musical stimuli that communicated coordinate locations, position of an auditory cursor and simple shapes. This paper applies those experimental findings to communicate simple diagrams in the presence and absence of a perceptual context to visually impaired users. An experimental platform, called AudioGraph, was used as a basis for these experiments.

2. Relevant work

The ability of people to remember random musical notes has been investigated in many experiments (Deutsch, 1970, 1972, 1973; Deutsch and Feroe, 1975). Random combinations of notes are remembered less well than structured and patterned sequences of notes with rhythm (Deutsch, 1980). This finding is also supported from other researchers that they have empirically concluded that notes should be selected from one octave and one must avoid random combinations of notes (Sumikawa et al., 1986). Other experiments (Sloboda, 1985) suggested that Deutsch's experiments did not use intervals from a common scale and the notes used did not form musical patterns. Remembering notes directly relates to the processes of short-term memory because the more items added to the short-term memory, the more likely is that other items may be lost (Miller, 1956). Evidence in the literature suggests that associating notes with strong representative titles will help people to remember those notes better (Delis et al., 1978).

In human–computer interfaces, earcons or simple musical motifs have been used to communicate information such as error messages. Examples of simple (one-element) earcons include a single note or digitized sound. Compound Earcons may use several combinations of simple earcons using inheritance or transformation (Blattner et al., 1989). Some guidelines for the creation of earcons have been produced (Brewster et al., 1995; Alty, 1995; Rigas, 1996; Rigas and Alty, 1998; Rigas et al., 2000). Several applications have been developed in which the use of simple or compound earcons has been evaluated. For example, communicate the contents of a

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