Multimodal Feedback for Tilt Controlled Speed Dependent Automatic Zooming

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ABSTRACT
Speed Dependent Automatic Zooming proposed by Igarashi and Hinckley is a powerful tool for document navigation on mobile devices. We show that browsing and targeting can be facilitated by using a model-based sonification approach to generate audio feedback about document structure, in a tilt-controlled SDAZ interface. We implemented this system for a text browser on a Pocket PC instrumented with an accelerometer and headset, and found that audio feedback provided valuable information, supporting intermittent interaction, i.e. allowing movement-based interaction techniques to continue while the user is simultaneously involved with other tasks. This was demonstrated by a blindfolded user successfully locating specified elements in a text file.

Additional Keywords and Phrases: Speed dependent automatic zooming, sonification, mobile devices

INTRODUCTION
Navigation techniques such as scrolling (or panning) and zooming are essential components of mobile device applications such as map browsing and reading text documents, allowing the user access to a larger information space than can be viewed on the small screen. Speed-dependent automatic zooming on mobile devices is a relatively new navigation technique[1] that unifies rate-based scrolling and zooming to overcome the limitations of typical scrolling interfaces and to prevent extreme visual flow. In [1] we demonstrated that SDAZ is well suited to implementation on mobile devices instrumented with tilt sensors, which can then be comfortably controlled in a single-handed fashion. Also, touch screen position control is a new feature in multimodal SDAZ which lets the user freeze the screen by shaking the PDA and tap the screen to select the target. The system automatically scrolls to the target and gradually zooms in fully.

The significant disadvantage of using motion as input in a handheld device is that it reduces the quality of the visual display for the duration of the input, due to reflections from the screen and difficulty in concentrating on a rapidly moving screen [5]. One solution is to use auditory feedback in such interaction scenarios. Audio or vibrotactile feedback may be crucial to support tasks or functionality on mobile devices that must continue even while the user is not looking at the display [3].

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1.(a) 1.(b)

Figure 1: Pocket PC and accelerometer attached to serial port (1a). 3 screen shots of the document browser (1b) showing a red box moving rapidly over the picture(left), the user finding the picture and landing there(middle), and the zoomed-in picture(right).

Scenario
The scenario we consider is that of reading and navigating documents. Documents and web pages are often used in a mobile context (for example, reading on a train) or while engaged in another tasks. Figure (1b) shows the tilt-scrolling interface for a text browser. On small screen devices, it is rare that the entirety of a document or a web page can be displayed at a comfortable resolution; due to the density of the information, effective scrolling and zooming techniques are an essential part of any document viewing software. Furthermore, reading a document involves at least two forms of browsing; searching for specific pieces of information or reading all of the document. We believe that the addition of audio feedback will provide additional benefits to this interaction. We have looked at two mechanisms by which we can support tilt-controlled SDAZ with audio feedback for rate of scrolling and structural information, to highlight specific information that is currently on the screen.

As an intuitive model of the sonification process, we can imagine the text on the screen to be embossed on the surface. This embossed type excites some object (elastic band or guitar string, for example) as it is dragged over the text. This physically motivated model is similar in nature to the model-based sonifications described in [2]. We simulate this model in our implementation by drawing an audio sample and placing that in an audio buffer, as each line on type "hits" the cursor. This technique is a form of granular synthesis; [6] gives other examples of granular synthesis in interaction contexts. A real world example would be the perception of continuous