Contentment & Communicating **Context**

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Context & Services

- Your experiences?
- …
- …

Humans are really good at it, eh?

- Dialects
- Sunny Swansea
- …
- Lucy Suchman
  - “Plans and Situated Actions”

Computers & Context

- Context-adaptation & mobile/ ubicomp systems (Abowd & Mynatt 2000)
  - Where
  - When
  - What
  - Why

"Context is a *slippery* notion"
(Paul Dourish)

Aside

- Context *Adaptation* vs. Context *Accommodation*
- *All* mobile systems should strive to ‘fit in’

Computers and Context

- My iPod
- Why are things hard to do?
  - Imperfect sensing (input)
  - Imperfect models; matching; modification (process)
  - Imperfect communication (output)

This workshop can help!

- perfecting sensing (input)
- perfecting models, matching, modification (process)
- perfecting communication (output)

Communicating context

- *“Notify a consumer as they enter a shopping center that an office supply store’s back-to-school sale is over in two hours; …*
- *Send tourists brief multimedia descriptions in the Washington, D.C. Mall as they enter each monument’s surrounding are; …*
- *Inform lottery players that they are close to the ‘pot of gold at the end of the rainbow’ and they should look for someone dressed as a leprechaun”*

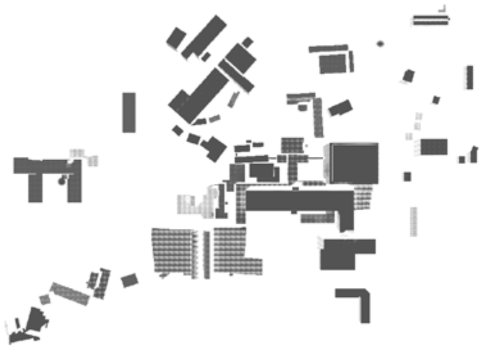
(Munson and Gupta 2002)

Trying to be more ecological – the *onTrack* System

- Music continuously adapted

Testing concept

- Virtual world – hospital grounds
- Lab-based
- Participants had to navigate from start-to-end points along path
- Path defined in terms of series of audio beacons
  - Stereo panning; volume adjustments w.r.t beacons
- Time taken, route etc recorded; task-load measured at end.
- 25 participants
  - 13 using audio system
  - 12 non-audio with paper map to assist (control)



Task completion rates/ times

Condition	Task success rate.	Mean successful task time (std. dev) *secs.*
Ontrack	32/38 (84%)	117.8 (110.8)
Map	28/32 (87%)	105.8 (57.1)

Table 1: Successful completion performance. 5 tasks were not logged due a software failure.

Condition	Route A	Route B	Route C
Ontrack	184.7(164.1)	57.1(13.9)	124.6(39.6)
Map	124.5 (51.2)	63.9(22.9)	120.2(69.1)

Table 2: Successful mean completion times in seconds (and standard deviations) for the three routes. Route presentation orders were randomised for each subject.

NASA Task Load (TLX) Subjective Ratings

Task-load dimension	*Ontrack* mean (std. dev)	*Map* mean (std. dev)
Mental effort	7.3 (2.3)	5.9 (2.4)
Perceived success	8.2 (1.5)	7.9 (1.5)
Performance satisfaction	8.1 (1.3)	7.6 (2.6)
Confidence in ability to complete tasks	8.4 (1.6)	8.0 (1.9)
Frustration level	8.7 (1.5)	7.1 (2.4)
Overall task load rating	8.1 (1.6)	7.3 (2.3)

Table 3: Subjective task load ratings for *Ontrack* and control. Normalised rating scale: 1 (least positive) to 10 (most positive rating).

- Map participants could refer to a map and often did so; *OnTrack* users only had music to guide them.
- Surprising were so successful (and fast)…
- Variations in time; but less so in paths; music has potential to lead…

Navigation Traces

In-wild prototype

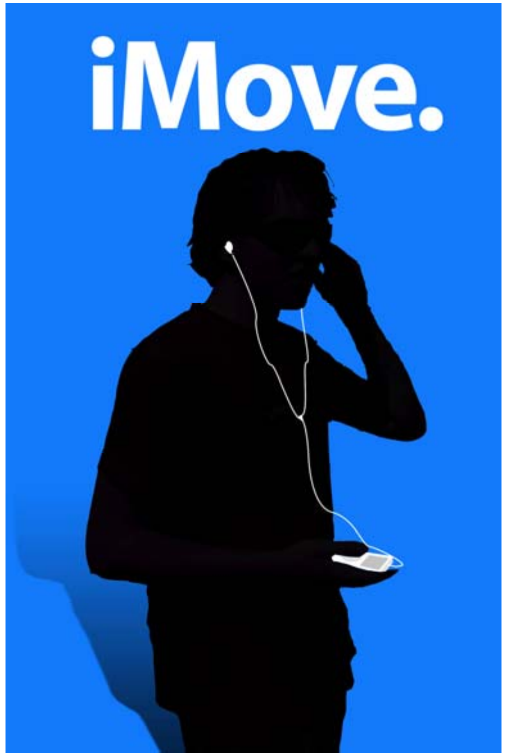
- Version 1 (nov. 2004)
  - Pocket PC, SysOn GPS
  - GPS errors/ non-signal
  - OK but not very robust
- Version 2 (aug. 2005)
  - GPS + electronic compass
  - Under testing…

Related work

- Speech cues
- Non-speech cues, spatial audio
  - AudioGPS (Holland et al, 2002), GuideShoes etc
- Minimal Attention Interfaces (Pascoe et al, 2000)
  - Hands/eyes free
- Ambience
  - On periphery; move to centre when need you to attend
- Management of context communication
  - C.f. NomadicRadio (Sawhney & Schmant, 2000)

Ongoing work

- Coping with uncertainty…
  - … imperfect location data
  - … moving targets
  - … profile/ context matches
- Audio ‘vocabulary’
  - C.f. work at Glasgow on earcons
- Applications
  - Tourist service
  - Rendezvous
  - Gaming
  - Child monitoring



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Navigation via Continuously Adapted Music

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ABSTRACT
Listening to music on personal, digital devices while mobile is an enjoyable, everyday activity. We explore a scheme for exploiting this practice to immerse listeners in navigation cues. Our prototype, *Ontrack*, continuously adapts audio, modifying the spatial balance and volume to lead listeners to their target destination. An initial lab-based evaluation has demonstrated the approach's efficacy: users were able to complete tasks within a reasonable time and their subjective feedback was positive. Encouraged by these findings, we are building a pocket-sized prototype for further testing.

Author Keywords
Mobile systems, navigation, audio, ambience, GPS.

ACM Classification Keywords
H5.5. Sound and music computing.

INTRODUCTION
Personal portable music players are essential pieces of street equipment. While such devices have been available for over a quarter of a century, recently digital versions have emerged. These provide powerful onboard processing and integration with other computing resources via fixed and wireless connections. Commercial services are exploiting these innovations providing, for instance, mobile online music purchase and graphical information to complement the audio stream.

Our interest, however, is the types of information that can be presented to a listener using only the music they are immersed in. Here, we introduce and evaluate the notion of adapting the acoustic signal to provide location and context awareness while mobile.

We have built a prototype system – *Ontrack* – to help a pedestrian navigate to a target destination via calm feedback. The concept is illustrated in this use-scenario:

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Ben is going to meet a friend in a restaurant across town. After alighting from the tram station closest to the restaurant, he puts on his headphones and turns on his portable music player to hear a new song he's just downloaded. At the same time, he turns on the navigate-by-music feature; the restaurant location was copied from the email his friend sent him.

He's fairly certain of the direction to head and as he moves off, the music playback is clear and strong, at a normal volume and through both headphones. As he approaches a cross-roads, Ben perceives the music shifting slightly to his left, with the volume decreasing. He crosses the road and heads in that direction and the music is now balanced and the volume returns to normal. As he walks further along the street, he notices the music beginning to fade, the volume is decreasing; he looks around and notices he's just walked past his destination.

The remainder of the paper is structured as follows. First we consider alternative approaches to assisting listeners as they navigate on foot, and place our work in the wider context of ambient interfaces. Next, we describe the implementation of the *Ontrack* lab prototype used to evaluate the scheme. The experimental method and result are then discussed. We conclude by outlining our ongoing work aimed at further understanding the role of the approach and the implementation on a pocket-sized device using readily available technology.

RELATED WORK
Commercial navigation systems routinely use speech to provide route guidance. In the research literature, there has also been interest in using discrete, meaningful clips of non-speech audio to convey directional information. Spatial audio – where the listener's perception of the location of the audio source is manipulated – has been used in conjunction with such notifications: e.g., a harpsichord tone emanating from the listener's left means they should move onwards in that direction [5]. In these systems, the user often walks around "listening" to silence, interrupted with audio cues when they need to take notice. For everyday users, this sort of scheme does not seem attractive: who wants to wear headphones to listen to nothingness interspersed with ambient noise? Rather, our approach is a symbiotic one, exploiting a desired, natural use of a personal player, it