A Control-Centric Approach to Designing Multimodal Interfaces for Small Computing Devices

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embarkinitiative
Investing in People and Ideas

Small Screen Devices: Mobile Offices

WIMP methods cannot be fully employed.

Mobile Devices Everywhere!

There is a need!

- **Small screen devices**
- Dynamics
- Feedback
- Problem setup

A proposed solution

- Continuous interaction
- A theoretical framework in HCI

Thesis contribution

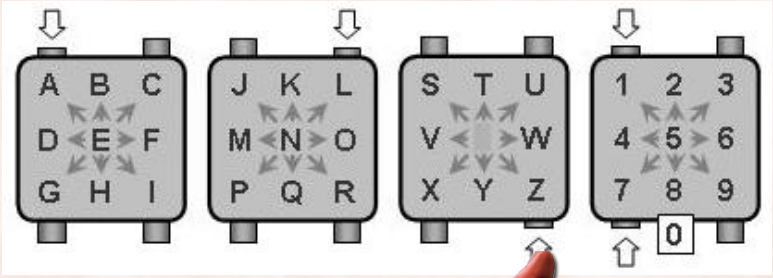
- Summary
- Publications

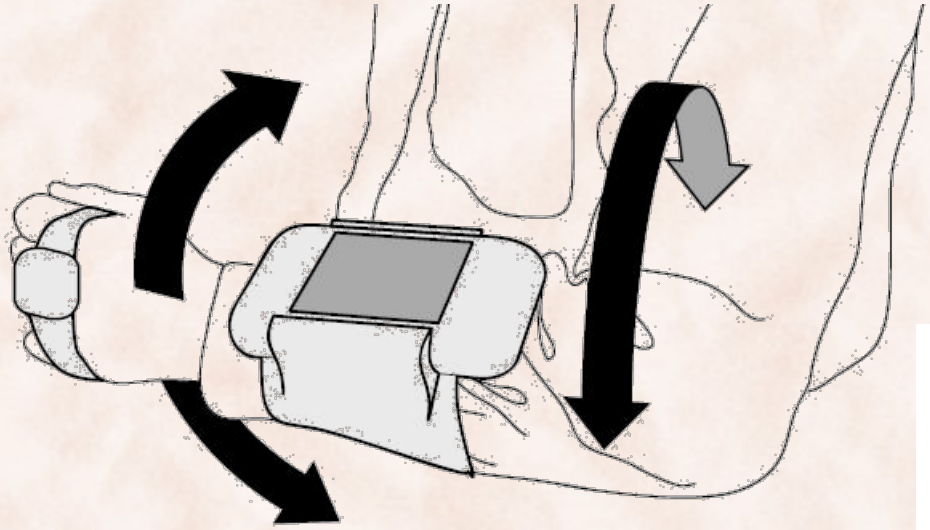
Outlook

- Future plans

Dynamics:

One-handed control





Example of interactive dynamic systems.

One-Handed Control

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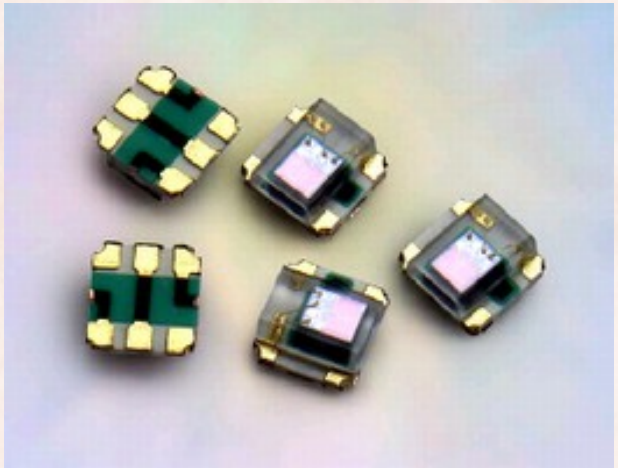
Feedback: Multimodality

Dependent on the display of feedback



Multimodality

There is a need!

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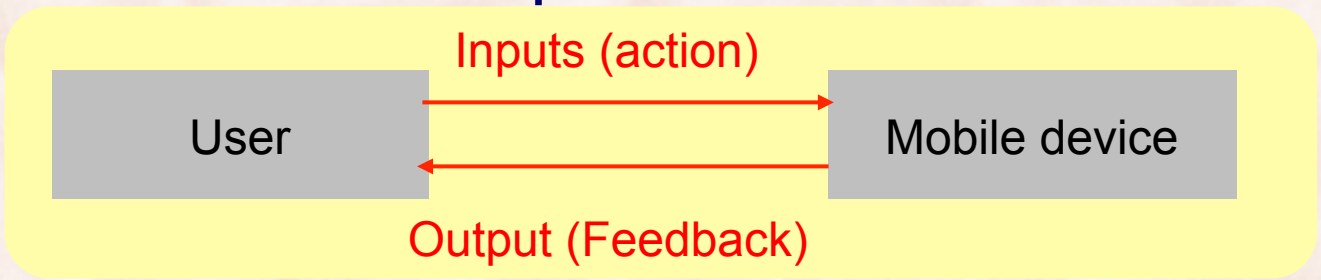
Device+ Feedback+Dynamics: Complex Problem



Complex & many interests!

The Problem!

There is a need!
- Small screen devices
- Dynamics
- Feedback
- **Problem setup**

A proposed solution
- Continuous interaction
- A theoretical framework in HCI

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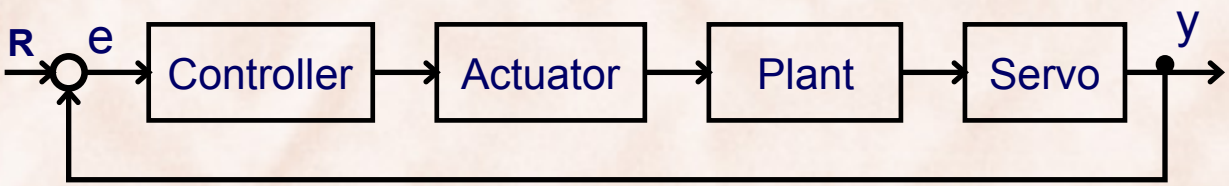
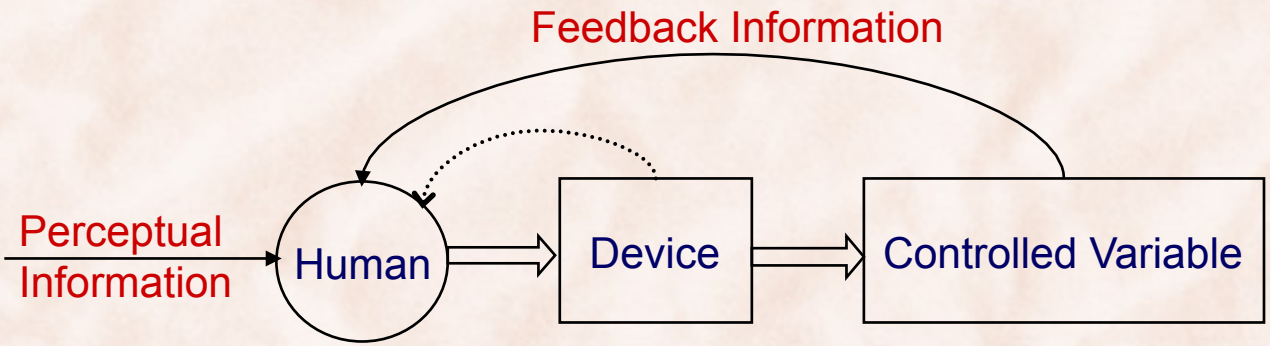
Feedback Control & HCI: Continuous control problem





We **control** what we **percieve**!

Continuous Control Problem

Need for a theoretical framework

Problem:

- Many experiments
- Yet not generalisable

Reason:

There is no theory of continuous interaction for designing and developing interfaces based on

dynamic systems,

continuous technologies and

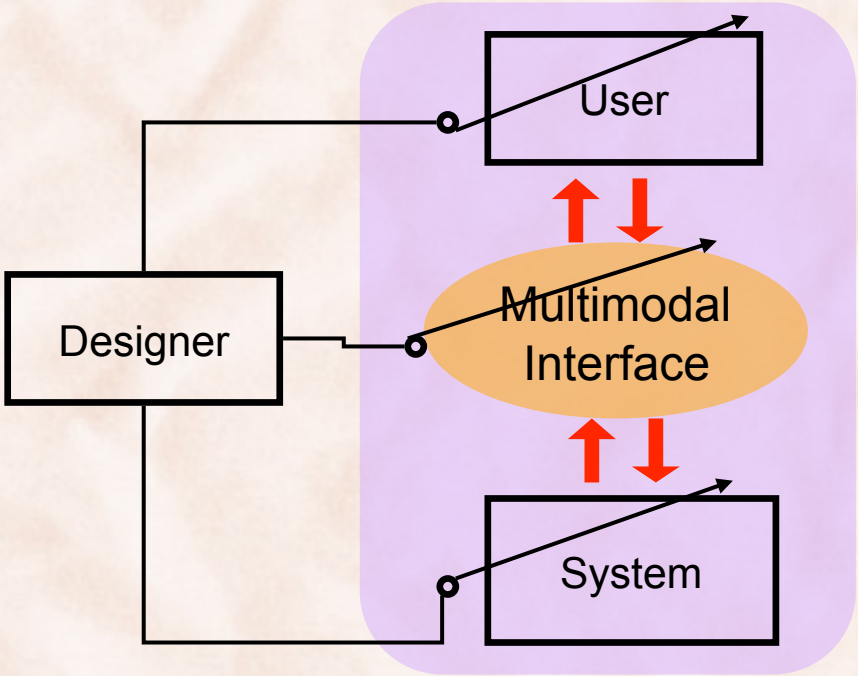
multimodal integration.

We need a theory!

We Need a Theory!

An old theoretical framework… but overlooked in HCI!

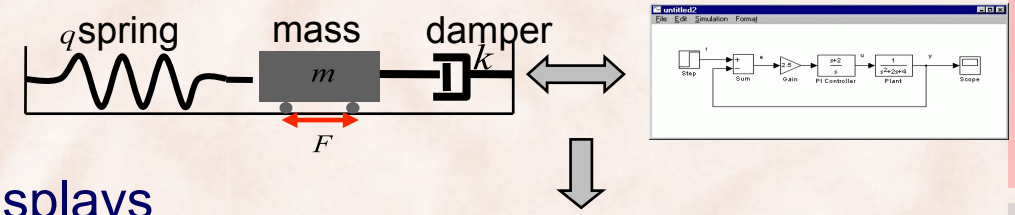
Proposed interaction metaphor



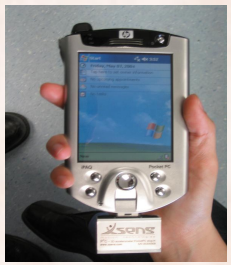
Incorporates analytical tools from control theory, probabilistic models,
&
integrates multimodality in a principled manner.

What Does This Theory Offer?

Achievements in the thesis



- Quickened displays
- Predictive feedback mechanism
- Pseudo-physical models
- Tuning parameters
- Intermittent interaction
- Adapting to user behaviour
- Coupling dynamic models to probability theory



Research on interaction with
portable computing devices,
tilt-controlled applications,
multimodal user interfaces, and
probability theory

Thesis Contributions

Publications

Model-Based Target Sonification

1. **P. Eslambolchilar**, R. Murray-Smith, A. Crossan, S. Dalzel-Job, F. Pollick . In J. Lumsden, editor, Handbook of Research on User Interface Design and Evaluation for Mobile Technology, chapter "*Model-based Target Sonification in Small Screen Devices: Perception and Action*". Idea Group Reference, 2007.
2. **P. Eslambolchilar**, A. Crossan, R. Murray-Smith ,"***Model based Target Sonification for Small Screen Devices***", Interactive sonification workshop, University of Bielefeld, Germany, 2004
3. S. Strachan, **P. Eslambolchilar**, R. Murray-Smith, "***GPSTunes - controlling navigation via audio feedback***", Mobile HCI05, Salzburg, Austria, 2005

Tilt-Controlled Zooming User Interfaces

1. **P. Eslambochilar**, J. Williamson, R. Murray-Smith, "***Multimodal Feedback for Tilt Controlled Speed Dependent Automatic Zooming***", UIST 2004, Santa Fe, 2004.
2. **P. Eslambolchilar**, R.Murray-Smith , "***Tilt based Automatic Zooming and Scaling in Mobile Devices, a State-Space Implementation***", Mobile HCI'04, Glasgow, Scotland, 2004.

Multimodal Motion Controlled Focus-in-Context Method: Sensing Complex Information

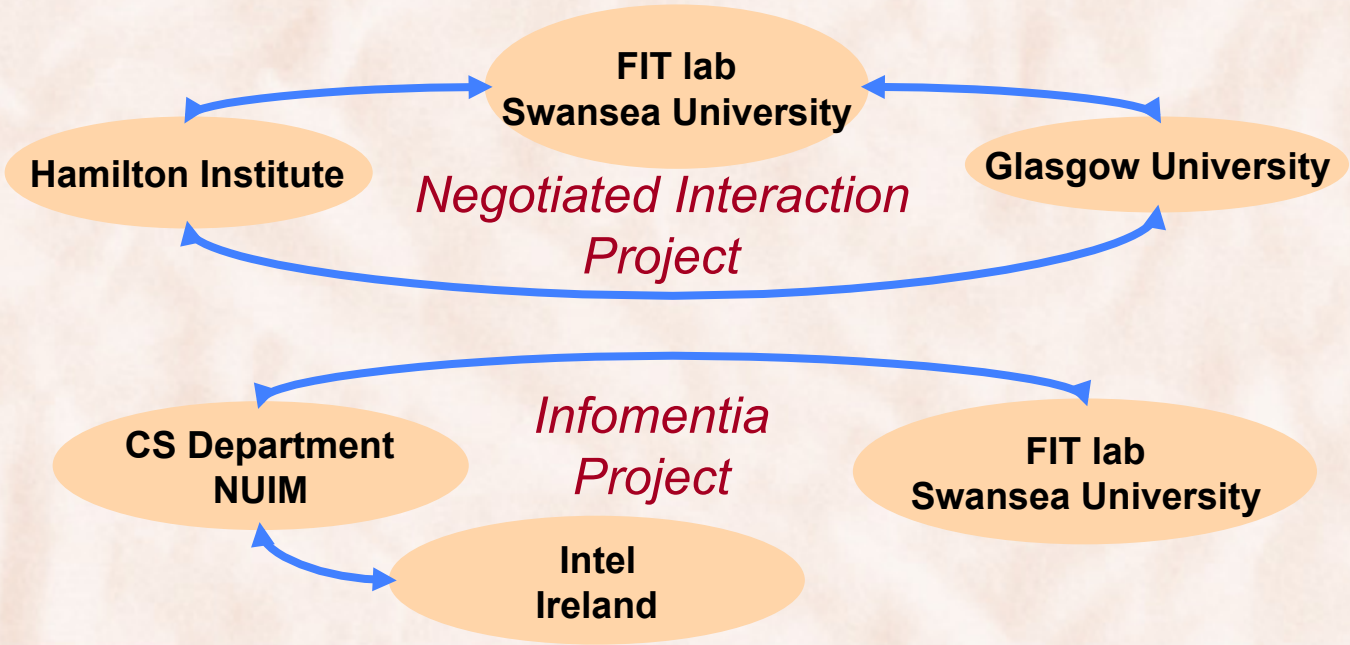
1. **P. Eslambolchilar**, R. Murray-Smith , "***Model-Based, Multimodal Interaction in Document Browsing***", Invited paper to the 3rd Joint Workshop in Multimodal Interaction and Related Machine Learning Algorithms, MLMI'06, Washington DC, USA, 2006.

1. **P. Eslambolchilar**, R. Murray-Smith. "Where is the user in the interaction?: Multimodal tilt-controlled SDAZ". In preparation for a journal paper, 2007.
2. **P. Eslambolchilar**, R. Murray-Smith. "Intermittent interaction in tilt-controlled ZUIs". In preparation for a journal paper, 2007.

Making Sense of Interaction Using a Model-Based Approach

- Interactive systems for users
- Toolkit for designers
- Novel inputs and sensing devices

It is an interesting metaphor for both designers and users!



Outlook