



Equipe IIHM :
Ingénierie de l'Interaction Homme-Machine

EHCI group:
Engineering for Human-Computer Interaction

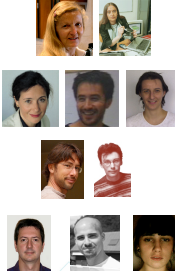
Laurence Nigay – laurence.nigay@imag.fr

EHCI group: Identity card

- Created in 1990
- Managed by Joëlle Coutaz until Sept. 2009
- 8 professors and assistant professors
- 1 CNRS researcher
- 1 CNRS research engineer part time
- 2 post-docs and 2 project engineers
- 10 PhD students
 - 4 PhD defenses in 2009 and 2 PhD defenses in 2010

EHCI group: Identity card

- 8 professors/assistant professors, 1 researcher and 1 research engineer
- Joëlle Coutaz, PRE UJF, 1973
- Laurence Nigay, PR1 UJF, 1994
- Gaëlle Calvary, PR2 GINP, 2000
- François Bérard, Lecturer GINP, 2001
- Sophie Dupuy-Chessa, Lecturer UPMF, 2002
- Renaud Blanch, Lecturer UJF, 2006
- Yann Laurillau, Lecturer UPMF, 2007
- Franck Tarpin-Bernard, PR2 UJF, 2009
- Michael Ortega, Research Engineer, 2010
- Céline Coutrix, Researcher, 2010



Outline

- Scientific overview
 - Scientific themes
 - Scientific approach
- Research themes and key results
- Perspectives

Scientific themes



- Software Engineering for HCI

Computer science contribution ↔ Interaction ↔ Supported by Human sciences

- Understanding the human-computer phenomena
- Establishing links between psychology-ergonomics and software engineering
- Designing, developing and evaluating interaction techniques
- Developing conceptual and technical tools based on HCI principles: Utility, Usability, Context

Scientific themes

- Software Engineering for HCI in the context of "Ambient Intelligence"
 - a seamless computing environment
 - unobtrusive, everywhere
 - often invisible and yet in our consciousness

Scientific themes

- Software Engineering for HCI in the context of "Ambient Intelligence"
- Unprecedented challenges for interaction design
 - Combining the real and virtual worlds
 - Multiple interaction devices/modalities
 - Small and large interaction surfaces
 - Dynamic contexts of use
 - Interaction adaptation - plasticity

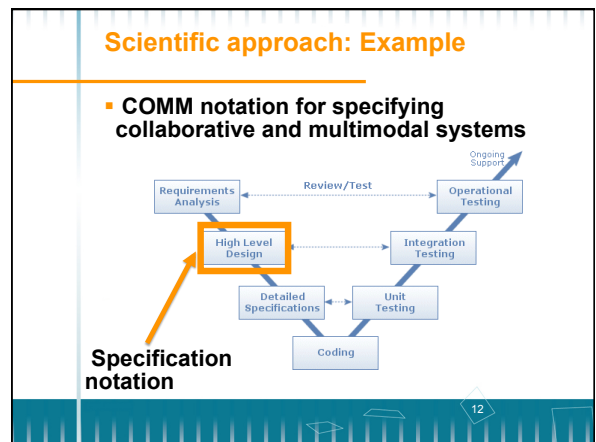
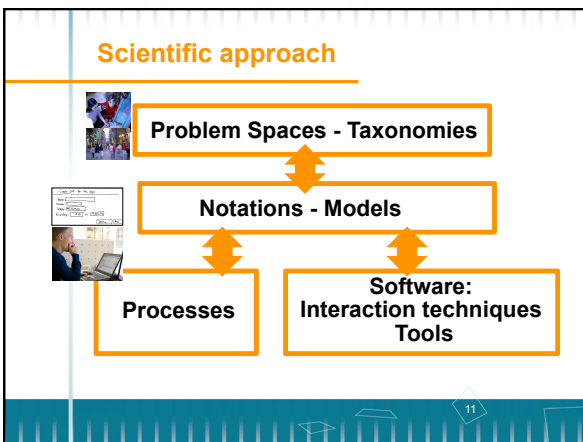
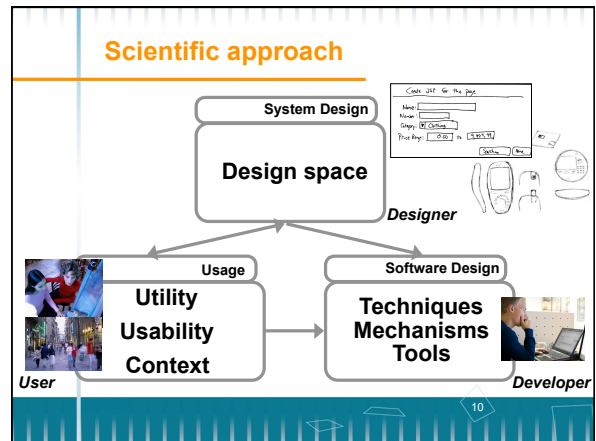
Scientific themes

- Software Engineering for HCI in the context of "Ambient Intelligence"
- Unprecedented challenges for interaction design
 - ... while defining an opportunity for the users' acceptance of innovative interaction techniques going beyond the desktop paradigm

The Xerox Star has reached its limits

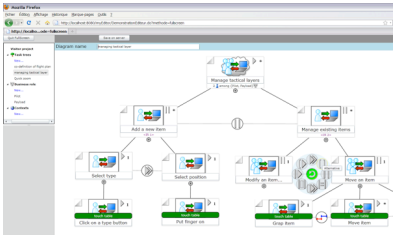
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Scientific approach: Example

- www.e-comm.fr.nf



Publ. IHM08, IHM09, EICS09, IHM10, EICS10


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- **Scientific overview**
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- **Research themes and key results**
- **Perspectives**

Research themes

- **Multimodal interaction**
- **Interaction with small handheld devices**
- **Mixed reality interaction**
- **User interface plasticity**
- **New interaction techniques**

Research themes



Research themes

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Multimodality

- **Modality <device, language> <gesture>**
- **A vast world of atomic and combined modalities**
 - any physical object can be involved in interaction as a device
- **Multimodality is an integrating vector for several recent interaction paradigms that include:**
 - perceptual user interfaces
 - tangible interfaces
 - augmented reality, etc.

Multimodality

- Facing the vast set of atomic and combined modalities

Interaction modelling at the modality level

- We can no longer expect to model each input and output modality in all their diversity at the concrete level
- We need to reason about modalities at a higher level of abstraction

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Multimodality

- Facing the vast set of atomic and combined modalities

Tools for the rapid development

- Developing multimodal interaction: a difficult task (ad-hoc development)
- Exploring the vast set of possibilities

Publ. HCI06 MobileHCI06 JMU107 EIS07 IUI07 ICMI07 ICMI08 ICMI09 JMU110

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Multimodality: Focus

OpenInterface STREP FP6

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Multimodality: Focus

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Multimodality: Focus

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Multimodality: Focus

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Multimodality: Focus

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Multimodality: Focus

OpenInterface
82 components including 30 devices

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Research themes

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Mobility

Key issues:
Transparency/Usability of mobile devices

Challenges for HCI

- Limited interactional resources
- Interaction in mobility

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Mobility

- Lack of input/output bandwidth
- New forms of interaction
- Toolkit
- Interaction techniques

Publ. MobileHCI06, INTERACT07, AVI08, MobileHCI09, AVI10

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Mobility: Focus

- Wavelet menu
- Problem space
 - Space on screen
 - No keyboard for shortcuts
 - One-hand interaction
 - Eye-free interaction

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Mobility: Focus

Wavelet menu



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Research themes

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Mixed Reality


- Merging the physical and the digital worlds so that users can take advantage of the two worlds in a smooth and seamless manner
- Augmented object: Conceptual model and prototyping tool
- Augmented surface: Interaction techniques and toolkit
- SE method

Publ. Start-up HiLabs, PERVASIVE05, ICVS06, AVI06, CAISE08, MobileHC108, AVI08, Visual Computer 09, Book Mixed Reality 09, Table Top09

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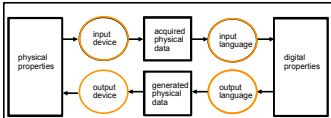
Mixed Reality: Focus

- Design of mixed objects and toolkit (OP)



- **Conceptual model**
 - Mixed Interaction Model (MIM)

Mixed object



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Mixed Reality: Focus

- **Bringing Digital Services to the Physical Workspace**

The Magic Table:
Gateway between Digital/Physical ink,
A tool for brainstorm meetings



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Mixed Reality: Focus

- **Bringing Digital Services to the Physical Workspace**

Adding single-user dual-finger interaction to the MERL DiamondTouch



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Plasticity

- **Starting point: our paper at Interact 99**
- **UI adaptation to the context of use while preserving human-centered values**
- **Reference framework (W3C), Adaptation patterns**
- **Models at runtime**
- **MDE, Plastic widgets, Component model/middleware**

Publ. IwC03, CACM05, MoDELS05, JMU107, INTERACT07, EIS07, DSVIS08, JMU108, IHM09, EICS10

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Plasticity: Focus

▪ The Reference Framework

- Context of use 1 -

User

Platform

Environment

- Quality in use 1 -

Criteria

Metrics

- Context of use 2 -

User

Platform

Environment

- Quality in use 2 -

Criteria

Metrics

Shows the many faces of plasticity: its intrinsic complexity (IwC'03)
Sustains the development and execution of plastic (Interact07) and non plastic UIs (EICS'10)

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Plasticity: Focus

▪ Example

When a PDA arrives ...

... the remote controller migrates to the PDA ...

While migrating, the remote controller is removed at the task level: it is no more possible to take notes on the PDA

... so that the user is mobile !

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Plasticity: Focus

- **Models at runtime: The graph of models elicited in the Reference Framework is alive at runtime (MDE)**
 - Explicit Metamodels
 - Adaptation = explicit models transformations
 - Transformations are put under the control of the end-user (End-user programming)

**Beyond plasticity:
Towards an
explicit, operational and reusable
know-how in HCI!**

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Research themes

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- **New interaction techniques**

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New Interaction Techniques

- Novel GUI-based interaction techniques to improve efficiency, comfort, and pleasure for generic HCI tasks
- Interactive visualization
- Pointing techniques
- Menu techniques

Publ. INTERACT07, INFOVIS07, AVI08, INTERACT09, CHI09, IHM10

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New Interaction Techniques: Focus

- **Zoomable Treemaps**
interactive visualization of large trees

Visualization is the focus of InfoVis, but interaction also needs to be efficient.

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New Interaction Techniques: Focus

- **Zoomable Treemaps**
interactive visualization of large trees

provide a coherent set of **structure-aware, multi-scale, navigation** techniques.

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Conclusion: Perspectives

			Multimodality
			Handheld devices
			Mobile Augmented Reality
Devpt Process	CSCW	End-user progr.	Mixed Reality
			Serious games: Experience (rather than performance)
			Plasticity
			New Interaction Techniques
			3D Interaction: Navigation/Docking
			Brain computing

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- **Thank you for your attention**

... more on iihm.imag.fr

Engineering Human-Computer Interaction Research Group

EHCI

- members
- publications
- contacts
- demos
- jobs
- access

Ben Fausch

The Engineering Human-Computer Interaction (EHCI) research group is one of the 24 research teams of the Grenoble Information Laboratory (LIG). EHCI is primarily concerned with the software aspects of Human-Computer Interaction. Our mission is to define new concepts, models and software tools for designing, implementing, and evaluating interaction techniques that are effective, usable, and enjoyable. This group has extensive experience in software architecture for interactive systems, multimodal and mixed reality interaction, context-aware distributed and migratory user interfaces.

To know more about the team: [identity card](#), [Oral presentation](#), and [Activity report \(2004-2009\)](#).

Research themes:

- Engineering for human-computer interaction: model, method, software architecture

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