INRIA

INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Project-Team in-situ

Situated interaction

Saclay - Île-de-France

Theme : Interaction and Visualization

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Established in 2002, the INSITU project is a collaboration between INRIA Saclay–Île-de-France and the Laboratoire de Recherche en Informatique (Laboratory for Computer Science) of Paris-Sud University and CNRS (Centre National de la Recherche Scientifique), originally established within the framework of the PCRI (Pôle Commun de Recherche en Informatique).

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2. Overall Objectives

2.1. Objectives

As computers permeate every aspect of society, the number and variety of computer users has multiplied dramatically as has the quantity and complexity of the data they manage. Computers are now ubiquitous and increasingly diverse, ranging from mobile phones and PDAs to laptops, desktops and wall-sized displays. Computers and telephony have converged to create a new communication medium, providing mobile access to myriad on-line services. This revolution poses major challenges for the design, implementation and deployment of interactive systems. The current failure to address these challenges has resulted in applications that are often difficult to understand or control, lowering productivity and increasing frustration. User interfaces have not kept pace with the rapid progress in other aspects in computing: The desktop metaphor that has driven personal computing for the past 25 years has reached its limits, with no short-term alternative.

The time has come for a new generation of interactive systems. The focus of the In Situ project is to create innovative interactive systems that truly meet the needs of their users. For us, context is critical: we need to provide designers with tools and methods that actively take context into account. This requires a deeper understanding of the complementary characteristics of humans and computers as well as an analysis of specific situations of use. Our goal is to develop and facilitate the creation of such situated interfaces, which take optimal advantage of context to provide users with the particular tools they need to address the problems at hand. Our approach both expands today's graphical user interfaces and explores new possibilities, addressing the following goals:

- *Flexibility* to support end-user customisation and programming as well as adaptation to physical context;
- *Integration of physical and electronic worlds* through the exploration of mixed reality and tangible interfaces;
- *Scalability* with respect to the quantity of data being managed, through the development of multi-scale interfaces and information visualisation techniques;
- *Cooperation and collaboration support* in order to study new forms of person-to-person mediated communication;
- *Integration* of varied interaction styles and techniques into a single coherent environment, using appropriate interaction models and architectures.

The overall goal of In Situ is to develop situated interfaces, i.e. interfaces that are adapted (or adaptable) to their contexts of use by taking advantage of complementary aspects of humans and computers. Our very ambitious longterm goal is to move beyond the current generation of desktop environments and envision the next generation of interactive environments. The specific objective for the next four years is to create one or more prototype interactive environments that begin to explore what this next generation of interactive systems might look like.

Our proposed research strategy is to develop case studies and development tools, in parallel. The case studies will allow us to study specific users, in particular application domains, and explore innovative interaction approaches in real-world contexts. The development tools, consisting of architectures and toolkits, will allow us to create a development environment for creating novel types of interaction and facilitate the creation of innovative applications. We have identified four research themes, each with separate deliverables, to achieve this objective: Interaction and Visualisation Paradigms, Mediated Communication, Research Methods and Engineering of Interactive Systems.

2.2. Research Themes

INSITU addresses four major research themes:

Interaction and visualization paradigms focuses on the trade-off between power and simplicity in interactive systems, both in terms of interaction and in managing and visualizing data. Rather than accepting one or the other, our objective is to shift the trade-off curve, creating systems that provide more power while retaining simplicity. We are currently investigating multi-scale (zoomable) interfaces, interactive information visualization, bimanual interaction, multimedia (video and audio) and tangible interfaces. Our goal is to not only explore these paradigms individually but also to investigate how to integrate them into real-world applications.

Mediated communication focuses on how to help people to maintain peripheral awareness of each others' activities at a distance (to "stay in touch"), while maintaining privacy and ensuring that users stay in control of their communication channels. Our objective is to generate a design space for alternative forms of communication, developing and testing new communication applications that illustrate different dimensions of the design space. We are currently developing communication appliances for home settings, including support for the elderly, children, remote couples and families.

Research methods focuses on how multi-disciplinary teams can create effective interactive systems that take context into account. Our objective is to create new research methods that include users throughout the design process, to test these methods in real-world settings and to disseminate these methods to researchers and designers. We are currently investigating participatory design techniques that actively involve users throughout the design process and multidisciplinary design techniques that facilitate communication among researchers from engineering, social science and design disciplines.

Engineering of interactive systems focuses on creating effective tools for building interactive systems. Our objective is to generate libraries, exploratory toolkits and platforms that enable us to quickly implement and work with new concepts, while also enabling researchers within and outside of INSITU to benefit from our research. We are currently investigating tools that facilitate the design and adoption of effective interaction techniques and paradigms and component-based architectures to facilitate dynamic management of interactive systems. Our goal is to develop open source toolkits that enable us and our research colleagues to design and implement advanced interactive systems.

Although we articulate each theme separately, we often intermix them within actual projects. We also work across disciplines, providing us with research breadth, and at the same time, seek to obtain depth in particular projects. We apply our own research methods to the design of new interaction techniques, develop our own tools for developing these techniques and integrate these techniques in the design of innovative interactive systems, which we test in real-world settings. Our long-term goal is to create a new generation of interactive environments that provide a compelling alternative to the current generation of desktop computers.

2.3. Highlights

INSITU had 3 papers accepted at the most prestigious conference in our field, ACM/CHI 2010.

Wendy Mackay and Michel Beaudouin-Lafon have been invited for a one-year sabbatical starting in August 2010 at Stanford University.

3. Scientific Foundations

3.1. Scientific Foundations

INSITU uses a multi-disciplinary research approach, including computer scientists, psychologists and designers. Working together requires an understanding of each other's methods. Much of computer science relies on formal theory, which, like mathematics, is evaluated with respect to its internal consistency. The social sciences are based more on descriptive theory, attempting to explain observed behaviour, without necessarily being able to predict it. The natural sciences seek predictive theory, using quantitative laws and models to not only explain, but also to anticipate and control naturally occurring phenomena. Finally, design is based on a corpus of accumulated knowledge, which is captured in design practice rather than scientific facts but is nevertheless very effective.

Combining these approaches is a major challenge. We are exploring an integrative approach that we call *generative theory*, which builds upon existing knowledge in order to create new categories of artefacts and explore their characteristics Our goal is to produce prototypes, research methods and software tools that facilitate the design, development and evaluation of interactive systems [32].

4. Application Domains

4.1. Application Domains

INSITU works actively with users from various application domains in order to understand their specific needs. By studying similar problems in different domains, we can generalize our results and develop more general principles. Our current application domains include:

- Scientific discovery, i.e. the use of advanced interactive technologies by scientists of other disciplines, in particular:
  - Biological research, in cooperation with the Institut Pasteur (Paris), INRA (Institut National de la Recherce Agronomique, Evry), INRA Metarisk[1] (Paris), and other laboratories of the University Paris-Sud;
  - Astronomy, in cooperation with the European Southern Observatory on the ALMA project[2] (Atacama Large Millimiter/submillimeter Array) and with SKA South Africa on MeerKAT[3], both for array operations monitoring and control of radiotelescopes; and with Institut d'Astrophysique Spatiale[4] on the visualization of large astronomy imagery using ultra-high-resolution wall-sized displays;
- Creative industries (music composition), in cooperation with IRCAM (Institut de Recherche et Coordination Acoustique-Musique, Paris);
- Domestic technologies, in cooperation with ENSCI (Ecole Nationale Supérieure de Création Industrielle, Paris).

We have selected these domains to ensure that we explore and address diverse validation criteria, e.g. enhancing productivity versus increasing communication access, diverse user characteristics, e.g. professionals versus non-professionals, and diverse user environments, e.g., desktops at work versus home versus mobile settings.

5. Software

5.1. Metisse

Participant: Olivier Chapuis [correspondant].

Metisse [35] is a window system that facilitates the design, implementation and evaluation of innovative window management techniques. The system is based on a compositing approach, making a clear distinction between the rendering and the interactive compositing processes. The Metisse server is a modified X server that supports both input and output redirection. The default compositor is a combination of a slightly modified version of FVWM, a standard window manager, with an interactive viewer application called *FvwmCompositor*.

[1] http://www.paris.inra.fr/metarisk
[2] http://www.almaobservatory.org/
[3] http://www.ska.ac.za/meerkat/
[4] http://www.ias.u-psud.fr

FvwmCompositor uses OpenGL to display windows, which offers a rich graphics model well adapted to the exploration of new window management techniques. Texture mapping, for example, makes it possible to transform the window shapes in real-time (Figure 1, left). Alpha blending makes it easy to create translucent objects and shadows. Scaling, rotation and translation can also be used to position windows in 2D$\frac{1}{2}$ or 3D (Figure 1, middle and right). Input redirection makes it still possible to interact with applications no matter the visual transformations applied to the windows. It also makes it possible to adapt, reconfigure or re-combine existing graphical interfaces [42]. This year we used again Metisse to implement novel desktop interaction techniques [3].

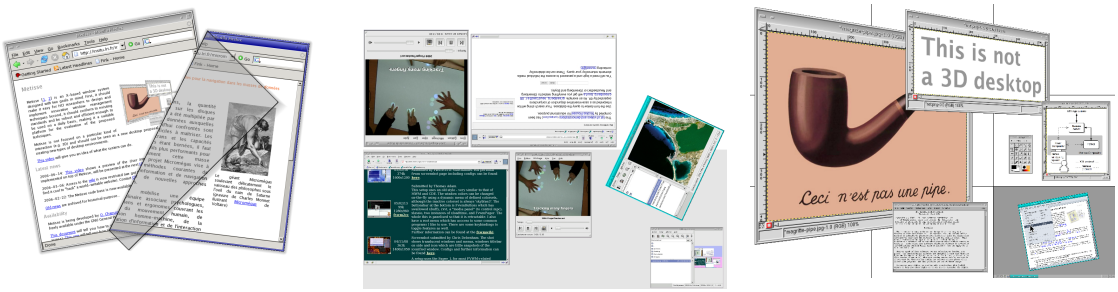

Figure 1. Sample window management techniques implemented with Metisse: extended paper metaphor (left), interactive table configuration that allows to duplicate and rotate windows (middle) and zoomable 3D desktop (right).

- Web: http://insitu.lri.fr/metisse/
- ACM: H.5.2 [User Interfaces]: Windowing systems
- Software benefit: see [35], [42], [36], [38] and [3].
- License: GPL
- Type of human computer interaction: Graphique
- OS/Middelware: X Window et Mac OS X
- Required library or software: OpenGL via nucleo[5] and some usual C/C++ libraries
- Programming language: * C/C++

5.2. Wmtrace

Participant: Olivier Chapuis [correspondant].

Wmtrace [34] includes two tools that help us study an individual user's window management activity. The first tool runs in the background of an X Window session and continuously logs information about windows and how they are being manipulated. The second uses a VCR-like interface (Figure 2) to replay the resulting logs and analyze the entire session. This tool provides several ways to filter the logs and extract high-level information, including interactive move events and mouse speed. Both tools allow HCI researchers to perform qualitative and quantitative statistical analyses of window management activity.

- Web: http://insitu.lri.fr/~chapuis/software/wmtrace/.
- ACM: H.5.2 [User Interfaces]: Windowing systems
- Software benefit: see [34], [38], [33].

[5] http://interaction.lille.inria.fr/~roussel/projects/nucleo/index.html

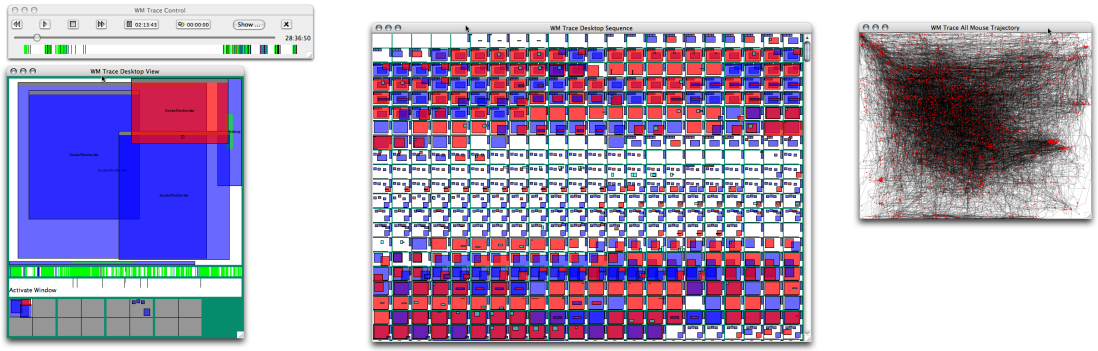

Figure 2. VCR-like interface, session overview and sample plots of mouse trajectories (black) and mouse clicks (red)

- License: GPL
- Type of human computer interaction: Deamon and Graphique
- OS/Middelware: X Window (deamon) and Java (VCR interface)
- Required library or software: all X libraries (daemon) and Java (VCR interface)
- Programming language: * C and Java

5.3. The SwingStates Toolkit

Participants: Caroline Appert [correspondant], Michel Beaudouin-Lafon.

SwingStates [1] is a library that adds state machines and a graphical canvas to the Java Swing user interface toolkit. It was motivated by the lack of widely disseminated toolkits that support advanced interaction techniques and the observation that HCI research toolkits are little used outside the lab. By extending the popular Java Swing toolkit rather than starting from scratch, the goal is to facilitate the dissemination and adoption of SwingStates by practitioners.

SwingStates uses *state machines* to specify interaction. It provides programmers with a natural syntax to specify state machines and reduces the potential for an explosion of the number of states by allowing multiple state machines to work together or separately. SwingStates can be used to add new interaction techniques to existing Swing widgets, e.g. to select buttons and checkboxes by crossing rather than clicking. It can also be used with the SwingStates canvas (see below) and to control high-level dialogues.

SwingStates also provides a powerful *canvas widget*. The canvas can contain any Java2D shape, including geometric shapes, images, text strings and even Swing widgets. Shapes can be manipulated individually or collectively, through *tags*. An intensive use of polymorphism allows to apply almost any command to a tag: the command is then applied to all objects with this tag. Tags are also used in conjunction with state machines, to specify transitions that occur only on objects with a given tag. For example, pie menus can be implemented by creating a canvas in the overlay layer of any Swing application (Figure 3).

SwingStates tightly integrates state machines, the Java language and the Swing toolkit to provide programmers with a natural and powerful extension to their natural programming environment. SwingStates is available at http://swingstates.sf.net under the GNU Lesser General Public License (LGPL).

5.4. The FlowStates Toolkit

Participants: Caroline Appert [correspondant], Michel Beaudouin-Lafon, Stéphane Huot.

Figure 3. A numeric text field whose value can be set by a joystick-like interaction (left) and a semi-transparent menu to change the background color of Swing widgets (right)

FlowStates [29], is a new toolkit to program advanced interaction techniques which require non standard input (e.g., two different mice that act independently, a joystick, a tablet, etc.). It is built on top of two existing toolkits: SwingStates [1] and ICon [37].

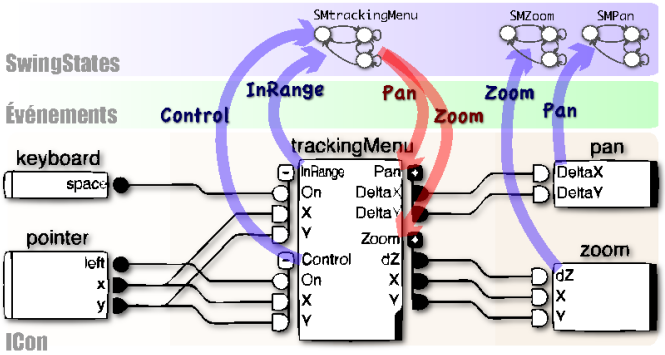

Figure 4. State machines and data flow in FlowStates

With FlowStates the developer can program interaction logic using state machines like SwingStates does but does not restrict the set of possible input channels to Java AWT standard input (a single couple <mouse, keyboard>). The state machines just have to define the virtual input events that are required to trigger their transitions so that FlowStates turns these machines into ICon devices which can be plugged to any physical input channels (Figure 4). An ICon device is a data flow building block that has input and output slots in order to be connected to other devices in the simple graphical environment provided by ICon. State machines can also send out events which appear as output slots in the data flow model.

With FlowStates we showed how two models for programming interaction (state machines and data flow) can be fully integrated to offer a huge power of expression. The explicit decision to not set strict limits between the roles of each model makes this hybrid approach highly flexible, the developer setting himself the limit between the two according to his needs and habits.

FlowStates is available at http://www.lri.fr/~appert/FlowStates/.

5.5. TouchStone

Participants: Caroline Appert [correspondant], Michel Beaudouin-Lafon, Wendy Mackay.

TouchStone [5] is a platform for designing, running and analyzing the results of controlled experiments (Figure 5). While it focuses on experiments comparing interaction techniques, it can be used in a wide variety of contexts.

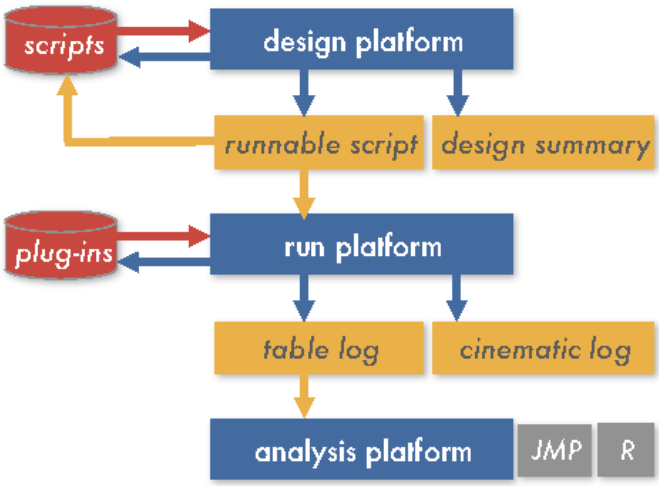

Figure 5. The architecture of the Touchstone platform

With the *Touchstone design platform*, a user specifies the factors and the measures of the experiment, the blocking and counterbalancing of trials, and assess the time it will take to run the experiment. Multiple designs can be explored in parallel to assess the various trade-offs. The output of the design platform is an XML file that can be used as input for the run platform.

The *Touchstone run platform* provides a framework to implement and run an experiment and to collect experimental data. It uses a flexible plug-in architecture to manage a variety of input devices and interaction techniques. The runs of the experiment are controlled by an XML script that can be produced by the design platform.

The analysis platform currently consists of data analysis tools such as JMP, R or Excel. Log data produced by the run platform can be directly loaded into any of these tools. In a future version, analysis sketches will be derived from the experimental design to assist with the analysis.

Touchstone has been used heavily at INSITU over the past two years for the many experiments that we design and run.

5.6. The Zoomable Visual Transformation Machine

Participants: Caroline Appert, Olivier Chapuis, Julien Husson, Emmanuel Pietriga [correspondant], Mathieu Nancel, Romain Primet.

ZVTM provides application programmers with building blocks for implementing complex multi-scale interface components that cannot be handled by traditional WIMP widgets. Featuring off-the-shelf visualisation and navigation components that are easy to combine, ZVTM provides a simple yet powerful API and handles low-level operations such as multi-threading, clipping, repaint requests and animation management. The toolkit is based on the metaphor of universes that can be observed through smart movable/zoomable cameras. The graphical object model permits management of a large number of complex geometrical shapes. It emphasises perceptual continuity via an advanced animation module that can animate virtually any on-screen modification. This ranges from camera movements and activation of distortion lenses to modification of the visual

variables of graphical objects. Various temporal pacing functions are available to control the execution of these animations. Current development activities around the toolkit now focus on multi-scale navigation techniques (focus+context, overview+detail) and making applications run transparently on cluster-driven high-resolution wall-sized displays such as the ultra-high-resolution wall-sized display of the WILD visualization platform.

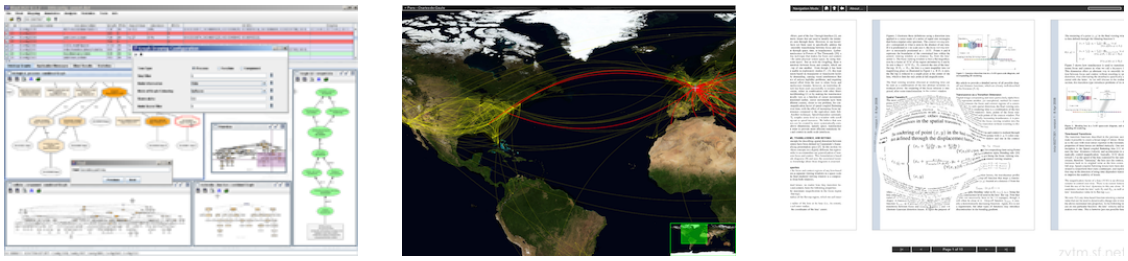

Figure 6. ZVTM used in various applications

Initially developed by Xerox Research Centre Europe and the World Wide Web Consortium (W3C) team at MIT, ZVTM has been available as open-source software under the GNU Lesser General Public License (LGPL) since early 2002. It is used in both academic and industrial projects such as IsaViz (http://www.w3.org/2001/11/IsaViz/), W3C's visual browser/editor for RDF, Blast2GO (Figure 6 - left) (http://www.blast2go.org/), or ZGRViewer (http://zvtm.sourceforge.net/zgrviewer.html) for viewing large graphs generated by AT&T GraphViz[6] (Figure 6 - right). The development of the toolkit is now supported by INRIA. More information can be found at http://zvtm.sourceforge.net and [40].

- ACM: H.5.2 [User Interfaces]: Graphical user interfaces (GUI)
- Software benefit: See Pietriga, A Toolkit for Addressing HCI Issues in Visual Language Environments, IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC '05), pages 145-152, September 2005
- License: LGPL
- Type of human computer interaction: Graphique
- OS/Middelware: Java (Linux, Mac OS X, Windows)
- Required library or software: several, managed through Maven
- Programming language: Java

5.7. The Substance Middleware

Participants: Michel Beaudouin-Lafon [correspondant], Clemens Nylandsted Klokmose, Tony Gjerlufsen, James Eagan, Clément Pillias.

Substance is a middleware based on a novel programming paradigm called *data-oriented programming* and was designed to facilitate the development of multi-surface interactive applications. Such applications are distributed by nature as they involve a varying number of display and interaction surfaces that are controlled by different computers. For example, our WILD room includes a 32-monitor display wall driven by 16 computers plus a front-end, a multi-touch table, various mobile devices such as iPodTouch and iPads, and the laptops that the users of the room may bring with them. We want to support seamless interaction techniques across these surfaces, such as the pick-and-drop technique pioneered by Rekimoto [41].

[6] http://www.graphviz.org

Data-oriented programming consists of attaching functionality to a tree data structure through *facets* attached to the individual nodes of the tree. Facets can be added and removed dynamically, and notified of changes in the tree. Substance supports two powerful ways to share nodes and facets: mounting, where access to the shared tree is managed through remotely, and replication, where the shared tree is replicated at each site and synchronized.

Figure 7. The Canvas (left) and SubstanceGrise (right) applications developed with Substance. (©CNRS-Phototheque - Cyril FRESILLON for SubstanceGrise).

Substance has been used to create two full-scale applications (Figure 7): a generalized Canvas that can display and manage graphics, PDF files, image files and other content (through an extensible content manager) across surfaces spanning multiple displays and computers; SubstanceGrise, which uses multiple instances of the Anatomist/BrainVISA application to display coordinated 3D imagery of many brains in parallel on the WILD wall and control from a physical model of the brain.

5.8. Scotty

Participants: Michel Beaudouin-Lafon [correspondant], James Eagan.

The goal of Scotty is to support *malleable interfaces*, i.e. interfaces that can be modified at run-time in ways not anticipated by the designers. Scotty is a toolkit that allows a programmer to extend an existing Mac OS X application without access to its source code. Scotty provides the following abstractions: hooks to alter the appearance of windows and widgets, event funnels to alter their behavior, glass sheets to overlay graphics and add new interaction methods, dynamic code loading and object proxies to redefine and extend existing objects. Scotty also provides a higher-level interface based on instrumental interaction [31]. Scotty currently runs on Mac OS X for applications written with the Cocoa user interface framework.

Scotty has been used to create a number of extensions (Figure 8). *Scribbler* is a generic extension that uses glass sheets to allow handwritten annotations of any Cocoa window. *Teleportation* is another generic extension that can teleport and resize the content of any Cocoa window onto another computer, including an iPhone or iPad. The user can interact with the teleported content as if it was on the original computer. It was used to create a content provider for the Substance Canvas (see above), making it possible to display any application running on a laptop onto the WILD wall display and/or table. When vector-based content is available, e.g., for text, Scotty provides smooth rescaling without the typical pixelation apparent when enlarging bitmap images. Finally *Stylesheet* is an extension to the Pages word processor that provides a semi-transparent toolglass for specifying the styles of paragraphs.

Figure 8. Using Scotty to teleport a window of a Mac OS X application onto an iPhone (left) and to create a toolglass in the Pages word processor (right).

6. New Results

6.1. Interaction Techniques

Participants: Caroline Appert, Olivier Bau, Michel Beaudouin-Lafon [correspondant], Olivier Chapuis, Guillaume Faure, Emilien Ghomi, Stéphane Huot, Mathieu Nancel, Cyprien Pindat, Emmanuel Pietriga, Theophanis Tsandilas, Julie Wagner.

Acquiring a target, such as pointing to an icon, a button or a landmark on a digital map, is the most common action in today's graphical user interfaces.

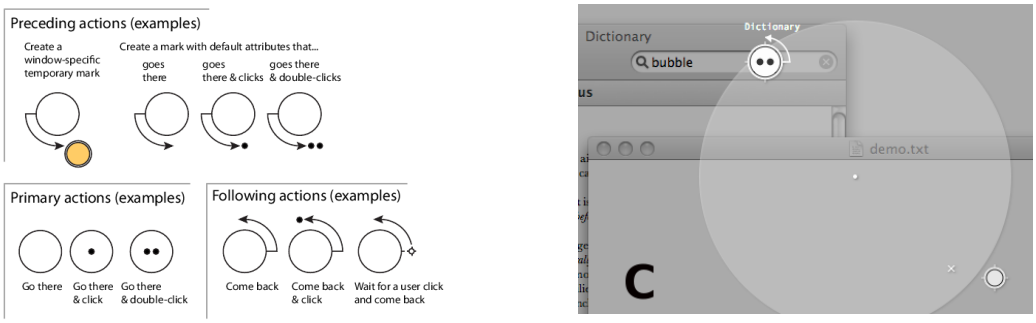

Figure 9. UImarks graphical marking language (left) and UImarks mode (right)

We have continued our work to better understand this seemingly simple action and make it faster and more reliable. We studied a novel adaptable pointing technique called UIMarks [3]. With UIMarks, users can specify on-screen targets and associated actions using a graphical marking language (Figure 9-left). UIMarks supplements traditional pointing by providing an alternative mode (Figure 9-right) in which users can quickly activate these marks. Associated actions can range from basic pointing facilitation to complex sequences possibly involving user interaction: one can leave a mark on a palette to make it more reachable, but the mark can also be configured to wait for a click and then automatically move the pointer back to its original location.

We further expanded our Sigma Lenses framework for focus+context visualization techniques [6] by addressing issues of quantization in multi-scale interfaces that arise with high magnification factors [17] (Figure 10).

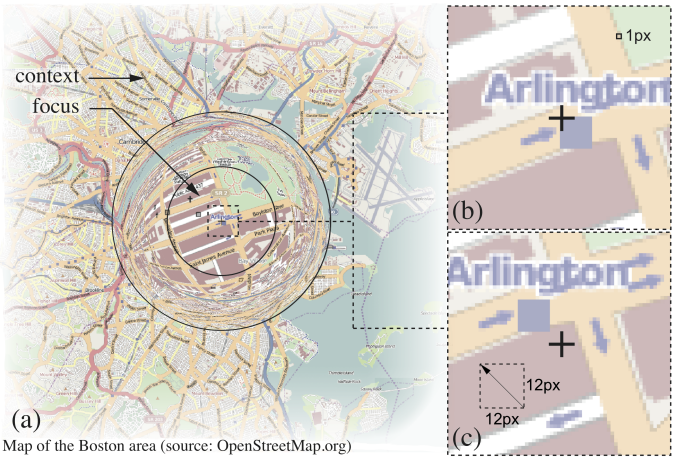

Figure 10. High-Precision Magnification Lenses

With today's input devices, the basic interaction vocabulary can be extended beyond pointing and clicking to include richer gesture-based interactions: pen input captures the pen's pressure and azimuth, multitouch surfaces capture multiple finger touches, etc. We have continued exploring the use of these new input dimensions: we improved the recognition of incomplete gestures [16] to support scale independence. This made OctoPocus, our dynamic guide that combines on-screen feedforward and feedback [30] to reveal possible gestures and guide users in their execution, even more powerful (Figure 11). We also explored how this approach can be used to improve the design and learning of multiple-finger gestures [26].

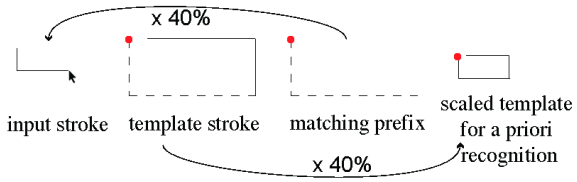

Figure 11. Scale detection for incomplete gestures - principle

Finally we continued our work on augmented paper. In paper-based interfaces, the lack of feedback makes menu navigation and command selection difficult. We created *Knotty gestures* [21], a technique for interacting with paper that combines the best qualities of both buttons and marks. Knotty gestures are tiny circular marks that can be added to any gesture and activated by simple pen interactions such as a press or a tap. They provide users with a subtle, in-the-flow-of-writing technique for tagging and structuring handwritten data and subsequently interacting with the paper (Figure 12). They have been carefully designed so that their activation does not interfere with regular writing. We have conducted two experiments to evaluate their design and recognition heuristics and demonstrated that people can successfully execute knotty gestures, even without feedback.

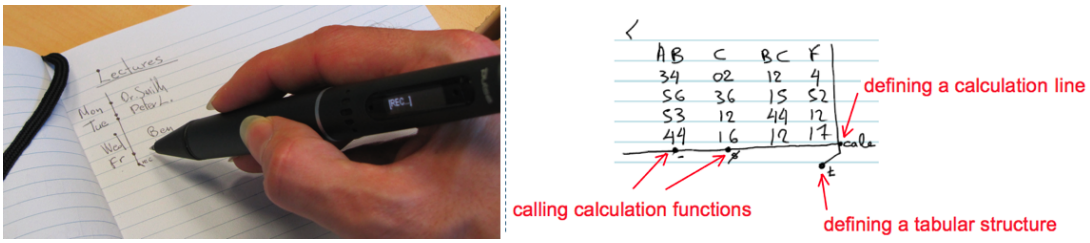

Figure 12. Interactive paper and knotty gestures

6.2. Mediated Communication

Participants: Michel Beaudouin-Lafon, Wendy Mackay [correspondant].

Our research on mediated communication, begun in 2002, has reached maturity and we are removing it from the list of themes for the next evaluation period as planned. Although we do not expect to begin new projects specifically in this area, we will benefit from what we learned from this research theme as we explore interaction and remote group work in large collaborative environments such as the WILD room.

We published a final paper, [14], in a major research journal that describes our work helping the elderly to successfully "age in place". We described the development and fieldtesting of *MarkerClock*, a *communication appliance* that provides a lightweight means for them to stay in touch with each other, enabling them to keep track of each other without feeling as though they are being watched by "Big Brother".

The ICI-TV technology maturation project (financed by Digiteo and completed in 2009), led to a new technology transfer project, called Buena Vista (see Section: Contracts with Industry). We are working with SDS (Splitted-Desktop Systems), a small company that creates complete solutions (end-user terminals, software stack and server back-end) for simple access to the internet. Our goal is to create a working demonstrator of a scalable system that will support intimate social networks, i.e. small networks of close friends and family who can communicate at multiple levels, via a private peer-to-peer network.

6.3. Research Methods

Participants: Stéphane Huot, Wendy Mackay [correspondant], Emmanuel Pietriga, Michel Beaudouin-Lafon, Olivier Chapuis, Caroline Appert.

This theme involves both using and testing research methods we had developed previously in our most recent work, and continuing to develop novel research methods.

We have been using *Participatory design* techniques to actively involve users in the design process, ranging from the scientific partners in the WILD project, to Wikipedia contributors, to the elderly, to composers at IRCAM. This method allows us to better understand users' specific needs in context as well as inspire new ideas. We conducted a series of participatory design workshops with biologists and astrophysicists and also ran a quasi-experiment with researchers that offered new insights into the sustainable use of interactive paper [22].

We interviewed and observed Wikipedia contributors and administrators as well as sociologists who study Wikipedia, which led to the development of WikipediaViz [20], a set of visual indicators to keep Wikipedia readers aware of important meta-information about the articles they read. We also conducted longitudinal field tests of *MarkerClock*, a technology probe designed to help the elderly age in place longer [14]. Finally, we provided contemporary music composers with Anoto pens, which were used as technology probes to better understand how they express novel musical ideas. This led to Knotty Gestures [21], which enable composers to sketch ideas and make them interactive, even playable, by adding tiny knots to hand-drawn lines.

We have also been using *TouchStone* to design and conduct controlled laboratory experiments to validate new algorithms and interaction techniques, including: high precision magnification lenses [17], UIMarks [3] and scale detection for incomplete gesture input [16].

6.4. Engineering of interactive systems

Participants: Caroline Appert, Michel Beaudouin-Lafon, Olivier Chapuis, James Eagan, Tony Gjerlufsen, Stéphane Huot, Wendy Mackay, Clemens Nylandsted Klokmose, Emmanuel Pietriga [correspondant], Clément Pillias, Romain Primet.

We enhanced our toolkits and platforms (see the Software section) to implement our novel interaction techniques and test them in real world applications. In particular, we implemented our new high-precision magnification lenses [17] in ZVTM, the UIMarks [3] adaptable pointing technique in Metisse and improved the gesture-recognition algorithm of SwingStates [16].

One of our major projects in this field is the WILD (Wall-sized Interaction with Large Datasets) platform (see Section 8.1). Our goal has been to develop software architectures and toolkits that will enable developers, including researchers from our discipline and from other domains, to run applications on a multi-device, cluster-based system. We have adapted our post-WIMP ZVTM toolkit so that applications initially developed for desktop environments can now run on WILD by changing only four lines of the original code. In order to manage and configure the various input sources of the platform, we developed the WILDInputServer (using [37], [29]). The WILDInputServer offers a visual language with which developers specify rich input configurations combining conventional input devices, touch-based interfaces running on iPhones and iPads and data about position and gestures made by users tracked by the VICON real-time motion tracking system.

We have been also experimenting with novel programming concepts for interaction in multi-surface, multi-device platforms such as WILD. We have extended our work on VIGO [39], based on our earlier work on Instrumental Interaction [31]. In the context of the ANR iStar project, we have been working on creating a generalized scene-graph approach and a programming environment called Substance based on a novel data-oriented programming model (see the Software section).

7. Contracts and Grants with Industry

7.1. Contracts with Industry

+ BuenaVista - INRIA Technology Transfer project (2010-2011). 60 Keuros (one year funding for an engineer). Wendy Mackay: coordinator and principal investigator. A follow-up to the earlier ICI-TV technology maturation project on communication appliances for intimate social networks. The goal is to transfer technology developed at InSitu to Splitted Desktop Systems (SDS), a small company specializing in simplified access to the internet through dedicated terminals. BuenaVista will support private social networks to help close friends and family to stay in touch. This is the opposite of public social networks such as Facebook, where the goal is to have a large number of friends. BuenaVista is designed for intimate communication over small, well-controlled groups.

7.2. Grants with Industry

+ Reactivity - INRIA-Microsoft Research project (2008-2010). 400 Keuros. Wendy Mackay: principal investigator. Partners: InSitu, INRIA/AVIZ, Microsoft Research VIBE. The goal of this project is to help researchers capture, visualize and interact with their own and their colleagues activities, over time. In this last year of the project we focused on paper-based interaction using the Anoto technology and Livescribe pens in combination with large interactive surfaces such as the WILD wall display. We also iterated the design of PageStreamer, an application that supports the interactive visualization of relationships among physical pages and online documents

+ ENSCI - DIGITEO action (2010). 10 Keuros. Wendy Mackay: principal investigator. Collaboration with professors at ENSCI design school and CEA to create a workshop for design students to explore innovative interfaces for green technology.

8. Other Grants and Activities

8.1. Regional Initiatives

+ WILD - Wall-sized Interaction with Large Datasets (2008-2011). 3 academic partners: LRI, INRIA and LIMSI-CNRS. Funded by RTRA Digiteo and Région Île-de-France, Domaine d'Intérêt Majeur "Logiciels et systèmes complexes": 429 Keuros. Emmanuel Pietriga & Michel Beaudouin-Lafon: coordinators and principal investigators. WILD is an experimental high-resolution, interactive platform for conducting research on collaborative human-computer interaction and the visualisation of large datasets. The platform is now being made available to scientists from other disciplines, including astrophysicists, biologists, chemists, as well as computer scientists, to visualise, explore and analyse their data.
+ WILD-PCRI (2010-2011). Extension of the WILD project (same partners) to extend the WILD platform with multi-channel audio capabilities and a flat-panel multitouch surface, and move it to the forthcoming PCRI building.
+ Design and evaluation of novel paper-based interfaces for large interactive surfaces (2010-2011). 24 Keuros. Funded by Univ. Paris-Sud ("Bonus attractivité"). This equipment grant will allow us to explore the use of paper-based interfaces by scientists in the context of the multi-surface interaction paradigm that we develop for the WILD platform.

8.2. National Initiatives

+ iStar - Multi-language interaction engine (2008-2011). 4 partners: ENAC (Toulouse), In Situ, IntuiLab (Start-up, Toulouse), Anyware Technologies (Toulouse). Funded by the French National Research Agency (ANR): 212 Keuros/955 Keuros. Michel Beaudouin-Lafon: principal investigator for In Situ. The goal of the project is to develop a programming environment for interactive applications that facilitates interoperability among components written in different languages and supports distributed interaction. In Situ contributes to the overall model and is developing a demonstrator on the WILD platform.
+ HolyRisk - Scientific Uncertainty and Food Risk Regulation (2009-2013). 5 academic partners. Funded by the French National Research Agency (ANR), Programme BLANC: 61 Keuros/702 Keuros. Emmanuel Pietriga: principal investigator for In Situ. This project is conducting a US/EU comparative empirical study that investigates the ways uncertainties are perceived, handled and expressed by experts throughout the food risk analysis process. In Situ is contributing a visual interface that allows efficient multi-scale navigation in a large corpus of annotated documents.
+ MLSN - Multi-Level Social Networks (2009-2012). 4 academic and industrial partners. Funded by the French National Research Agency (ANR), Programme VERSO: 177 Keuros/738 Keuros. Emmanuel Pietriga: principal investigator for In Situ. Real-time social network visualisation of multiplex social interactions. MLSN is based on recent findings in academic research on graph drawing/navigation techniques and on network analysis

8.3. International Initiatives

+ ALMA (Atacama Large Millimeter/submillimeter Array, http://www.almaobservatory.org/) (Principal Investigator: Emmanuel Pietriga): Collaboration over 1.5 years with the European Southern Observatory (ESO), the National Astronomical Observatory of Japan (NAOJ), and the National Radio Astronomy Observatory (NRAO)/NSF to redesign graphical user interfaces of the observatory's operations monitoring and control software, based on state-of-the-art visualisation and interaction techniques. The project will partly be implemented using In Situ's ZVTM toolkit (see Section 5.6).

+ MeerKAT (http://www.ska.ac.za/meerkat/) (Principal Investigator: Emmanuel Pietriga): Collaboration with SKA South Africa and CNAM (Conservatoire National des Arts et Métiers) on the design of user interfaces for the MeerKAT radiotelescope, one of the precursors of the Square Kilometer Array (SKA).

9. Dissemination

9.1. Keynote addresses and Invited Lectures

- Emmanuel Pietriga: "HCI state-of-the-art and what it means for ALMA", European Southern Observatory, Garching, Germany, March 2010.
- Caroline Appert: "Programming and using gestural interaction", Forum on tactile and gestural interaction, Lille, France, June 2010.
- James Eagan: "Multi-Surface Interaction in the WILD", Open University, Milton-Keynes, UK, August 2010.
- P. Cubaud, E. Pietriga, "HCI and Information Visualization Research: an Overview", SKA South Africa, Cape Town, South Africa, November 2010.
- James Eagan: "Runtime User Interface Programming & Multi-Surface Environments", Télécom-ParisTech, Paris, France, November 2010.
- Wendy Mackay: "Situated Interaction: Creating a Partnership between People and Intelligent Systems", G. Morgenstern Colloquium, INRIA, Sophia Antipolis, May 2010.
- Emmanuel Pietriga and Wendy Mackay: "The Wild Platform: Wall-Size Interaction with Large Datasets", INRIA, Sophia Antipolis, May 2010.
- Wendy Mackay: "Interactive Paper: From Creative Expression to Computational Power", EPFL, Lausanne, Switzerland, July 2010.
- Wendy Mackay: "Situated Interaction", Stanford University, USA, October 2010.
- Michel Beaudouin-Lafon: "Interfaces et Interactions", Rencontres SPECIF, Tours, France, January 2010.
- Michel Beaudouin-Lafon: "WILD - Wall-Size Interaction with Large Datasets", Rencontres prospectives du LAL, Seillac, France, May 2010.
- Michel Beaudouin-Laofn: "Introduction to the 2009 Turing Award Lecture by Charles Thacker", Saint-Malo, France, June 2010.
- Michel Beaudouin-Lafon: "Geste et Interaction", Séminaire Le Geste Comme Langage, IRI Centre Pompidou, Paris, France, June 2010.
- Michel Beaudouin-Lafon: "Interaction beyond Computation", EPFL, Lausanne, Switzerland, July 2010.
- Michel Beaudouin-Lafon: "WILD - Wall-Size Interaction with Large Datasets", Stanford University, USA, October 2010.

9.2. Journal editorial board

- Communications of the ACM (CACM), ACM: Wendy Mackay (Member of editorial board for web edition)
- Transactions on Computer-Human Interaction (TOCHI), ACM: Michel Beaudouin-Lafon (Associate Editor)
- International Journal of Human-Computer Studies (IJHCS), Elsevier: Michel Beaudouin-Lafon (Member of the Advisory Board)

- Journal of Computer-Supported Cooperative Work (JCSCW), Springer: Michel Beaudouin-Lafon (Member of the Advisory Board)
- Revue Information-Interaction-Intelligence (Revue I3), Cépaduès: Michel Beaudouin-Lafon (Member of the Advisory Board)
- Journal d'Interaction Personne-Système (JIPS), AFIHM: Michel Beaudouin-Lafon (Member of editorial board)

9.3. Journal reviewing

- ACM Transactions on Computer-Human Interaction (ToCHI): Olivier Chapuis, James Eagan, Clemens Nylandsted Klokmose, Wendy Mackay
- IEEE Transactions on Visualization and Computer Graphics (TVCG): Emmanuel Pietriga
- Human-Computer Interaction (HCI): Wendy Mackay
- Computers & Graphics (Elsevier): Emmanuel Pietriga
- IJHCS - International Journal of Human-Computer Studies (Elsevier): Clemens Nylandsted Klokmose, Theophanis Tsandilas
- Information Visualization Journal (Palgrave Macmillan): James Eagan
- JIPS - Journal d'Interaction Personne-Système (AFIHM): Stéphane Huot

9.4. Conference organization

- ACM CHI 2010 - 27th ACM Conference on Human Factors in Computing Systems: Wendy Mackay (Subcommittee Co-Chair), Michel Beaudouin-Lafon (Subcommittee Co-Chair), Olivier Chapuis (Program Committee member)
- ACM UIST 2010 - ACM Symposium on User Interface Software and Technology (UIST): Michel Beaudouin-Lafon (Program Committee member), Caroline Appert (Poster Committee member)
- ACM CSCW 2010 - ACM Conference on Computer Supported Cooperative Work: Michel Beaudouin-Lafon (Program Committee member), Ilaria Liccardi (Student Volunteers Co-Chair)
- ACM CSCW 2011 - ACM Conference on Computer Supported Cooperative Work: Wendy Mackay, Michel Beaudouin-Lafon (Program Committee members)
- ACM UbiComp 2010 - International Conference on Ubiquitous Computing: Wendy Mackay (Program committee member)
- ACM DIS 2010 - ACM Conference on Designing Interactive Systems: Wendy Mackay (Program committee member)
- VL/HCC 2010 - IEEE Symposium on Visual Languages and Human-Centric Computing: Emmanuel Pietriga (Program Co-Chair)
- ACM/BCS Visions of Computer Science 2010: Michel Beaudouin-Lafon (Program Committee member)
- ISMAR 2010 - IEEE and ACM International Symposium on Mixed and Augmented Reality: Wendy Mackay (Area chair)
- IHM 2010 - Conférence Francophone d'Interaction Homme-Machine: Stéphane Huot (Program Committee member, Papers Co-Chair), Michel Beaudouin-Lafon (Program Committee member)
- VINCI 2010 - Visual Information Communications International: Emmanuel Pietriga (Program Committee member)
- Graduate Consortium: Democratizing Computational Tools (in conjunction with VL/HCC '10): Emmanuel Pietriga (panelist)

9.5. Conference reviewing

- ACM CHI 2010: Caroline Appert, James Eagan, Stéphane Huot, Ilaria Liccardi, Clemens Nylandsted Klokmose, Emmanuel Pietriga, Theophanis Tsandilas, Julie Wagner
- ACM UIST 2010: Caroline Appert, Olivier Chapuis, Stéphane Huot, Clemens Nylandsted Klokmose, Julie Wagner
- ACM CSCW 2010: James Eagan, Ilaria Liccardi, Emmanuel Pietriga
- ACM SIGGRAPH 2010: Michel Beaudouin-Lafon
- IEEE InfoVis 2010: Emmanuel Pietriga
- IEEE VAST 2010: Emmanuel Pietriga
- ACM DIS 2010 - Designing Interactive Systems: James Eagan, Clemens Nylandsted Klokmose, Theophanis Tsandilas
- ACM HT 2010: Benjamin Bach, Ilaria Liccardi
- ACM ITS 2010: Olivier Chapuis
- ACM EICS 2010: Michel Beaudouin-Lafon
- NordiCHI 2010 - 6th Nordic Conference on Human-Computer Interaction: Clemens Nylandsted Klokmose
- ISMAR 2010 - IEEE and ACM International Symposium on Mixed and Augmented Reality: James Eagan, Clemens Nylandsted Klokmose
- UbiComp 2010 - 12th ACM International Conference on Ubiquitous Computing: Clemens Nylandsted Klokmose
- IHM 2010: Olivier Chapuis, Emmanuel Pietriga

9.6. Scientific associations

- ACM: Michel Beaudouin-Lafon member of the ACM Europe Council (since 2009)
- ACM SIGCHI Paris Local Chapter: Emmanuel Pietriga (Chair), Julie Wagner (Seminars Co-Organizer, Webmaster)
- AFIHM (French speaking HCI asssociation): Michel Beaudouin-Lafon member of the Scientific Board (CPPMS)

9.7. Evaluation committees and invited expertise

- European Research Council (ERC), Advanced Grants evaluation panel PE6-A (computer science), member: Michel Beaudouin-Lafon
- SEE-ERA.NET PLUS Joint Call for European Research Projects, evaluator: Emmanuel Pietriga
- Expert reviewer for an ongoing European Commission 7th Framework Programme project (Strategic Objective 4.2: Intelligent Content and Semantics): Emmanuel Pietriga
- Expert reviewer for the mid-term evaluation of the EPSRC-funded “Contextual Software” project (UK): Michel Beaudouin-Lafon
- Expert reviewer for NSERC (Canada): Michel Beaudouin-Lafon
- Reviewer for tenure case at a North-American University: Michel Beaudouin-Lafon
- Vice-President for Research, Computer Science Dpt., Univ. Paris-Sud: Wendy Mackay (until August 2010)
- Assessment Committee (“Commission d’Evaluation”), INRIA, elected representative: Wendy Mackay

- Area committee for Information and Communication Science and Technology, National Research Agency (Comité Sectoriel STIC de l'ANR), member: Michel Beaudouin-Lafon
- Gilles Kahn thesis prize 2010, jury member: Caroline Appert
- ALLISTENE (Alliance des Sciences et Technologies du Numérique) working group on Knowledge, Content and Interaction, members: Wendy Mackay, Michel Beaudouin-Lafon
- Digiteo Steering Committee (Comité de Pilotage du RTRA Digiteo), member: Michel Beaudouin-Lafon
- IRCAM (Paris) Scientific Committee, member: Michel Beaudouin-Lafon
- Scientific Committee of the ISD Program (Information Systems Dynamics), Fondation CIGREF (Club Informatique des Grandes Entreprises Françaises): Michel Beaudouin-Lafon (member), Wendy Mackay (reviewer)
- TELECOM ParisTech Research Committee, member: Michel Beaudouin-Lafon
- INRIA hiring committee (senior researcher), member: Wendy Mackay
- INRIA Rennes hiring committee (junior researcher), member: Wendy Mackay
- INRIA Promotion committee, member: Wendy Mackay
- INRIA thematic committee for the Perception, Cognition and Interaction area, member: Wendy Mackay
- INRIA-Saclay Scientific Commission, member: Michel Beaudouin-Lafon
- Univ. Paris-Sud hiring committee, Commission Consultative des Spécialistes de l'Université 27ème section (computer science), members: Michel Beaudouin-Lafon, Stéphane Huot, Wendy Mackay
- Univ. Paris-Sud hiring committee, Comité de Sélection 27ème section (computer science), members: Olivier Chapuis, Stéphane Huot, Michel Beaudouin-Lafon
- Univ. Nantes hiring committee, Comité de Sélection 27ème section (computer science), member: Michel Beaudouin-Lafon
- ENS Cachan hiring committee, Comité de Sélection 70ème section (educational sciences), member: Michel Beaudouin-Lafon
- Assessment Committee for project proposals, INRIA, member: Wendy Mackay
- Univ. Paris-Sud Promotion committee, member: Wendy Mackay
- Assessment Committee "BQR Financier", Univ. Paris-Sud, jury member: Wendy Mackay
- Assessment Committee "BQR Emploi", Univ. Paris-Sud, jury member: Wendy Mackay
- Assessment Committee "Mutualisation des moyens de la recherche", Univ. Paris-Sud, jury member: Wendy Mackay
- Assessment Committee "Bonus Attractivité", Univ. Paris-Sud, jury member: Wendy Mackay
- Review committee for "Habilitation à Diriger des Rechercher", Univ. Paris-Sud, member: Wendy Mackay

9.8. PhD defenses

- Olivier Bau (Univ. Paris-Sud, Orsay): Wendy Mackay, advisor
- Guillaume Besacier (Univ. Paris-Sud, Orsay): Michel Beaudouin-Lafon, advisor
- Guillaume Zuffery (EPFL, Lausanne, Switzerland): Michel Beaudouin-Lafon, reviewer
- Anne Roudaut (Telecom ParisTech, Paris): Michel Beaudouin-Lafon, reviewer
- Shuo-Hsiu Hsu (Conservatoire National des Arts et Métiers, Paris): Emmanuel Pietrga, examiner
- Xu Quan (Université des Sciences et Technologies de Lille): Olivier Chapuis, examiner

9.9. Teaching

- IUT Orsay: Stéphane Huot (Graphical Interfaces Programming, Java Programming, Projects and Internships Advisor)
- Polytech Paris-Sud: Olivier Chapuis (Introduction to HCI)
- Master IAC (Univ. Paris-Sud) - HCI and Information Visualization: Caroline Appert (Coordinator), Olivier Chapuis, Stéphane Huot, Theophanis Tsandilas
- Master in Computer Science: Michel Beaudouin-Lafon (Introduction to Human-Computer Interaction, Fundamentals of Computer-Human-Interaction, Design and Evaluation of Interactive Systems), Wendy Mackay, (Design and Evaluation of Interactive Systems), Wendy Mackay (Technical Writing in English)
- Rencontres Jeunes Chercheurs en IHM, Montpellier: Wendy Mackay (Technical Writing in English pour les français)
- Ecole Doctorale d'Informatique Paris-Sud: Wendy Mackay (Technical Writing in English pour les français)
- Ecole Polytechnique: Wendy Mackay (Research advisor for student projects on communication appliances)
- Les Atelies ENSCI: Wendy Mackay (jury member for student projects)
- UC Berkely: Wendy Mackay and Michel Beaudouin-Lafon (jury members for student projects)

9.10. Dissemination

- "L'internet pour tous : le développement est-il uniquement conditionné par l'accès au numérique" - Forum Le Monde - La Recherche, Collège de France, Paris, July 2010. Talk and panel discussion: Wendy Mackay.
- "Fête de la science" 2010 at LRI, Coordinators: Caroline Appert and Theophanis Tsandilas
- "Les Jeudis de la Recherche" - Centre de Vulgarisation de la Connaissance (Université Paris-Sud & CNRS): WILD, un mur d'images interactif au service des scientifiques, Speaker: Emmanuel Pietriga
- "La ville participative des citoyens acteurs: de nouveaux outils pour de nouveaux usages" - Rencontres INRIA-Industrie, Jouy-en-Josas, June 2010. Speaker: Wendy Mackay.
- "Les Rencontres INRIA-Industrie", 2010. Demonstrations of the WILD platform by Wendy Mackay and the Knotty Gestures by Theophanis Tsandilas.

10. Bibliography

Major publications by the team in recent years

[1] C. APPERT, M. BEAUDOUIN-LAFON. *SwingStates: Adding State Machines to Java and the Swing Toolkit*, in "Software: Practice and Experience", 2008, vol. 38, n° 11, p. 1149 - 1182, http://dx.doi.org/10.1002/spe.867.

[2] O. CHAPUIS, J.-B. LABRUNE, E. PIETRIGA. *DynaSpot: speed-dependent area cursor*, in "CHI '09: Proceedings of the 27th international conference on Human factors in computing systems", ACM, 2009, p. 1391–1400, http://doi.acm.org/10.1145/1518701.1518911, http://hal.archives-ouvertes.fr/inria-00373678.

[3] O. CHAPUIS, N. ROUSSEL. *UIMarks: Quick Graphical Interaction with Specific Targets*, in "UIST '10: Proceedings of the 23rd annual ACM symposium on User interface software and technology", ACM, October 2010, p. 173–182, http://doi.acm.org/10.1145/1866029.1866057, http://hal.archives-ouvertes.fr/inria-00533398.

[4] H. HUTCHINSON, W. MACKAY, B. WESTERLUND, B. BEDERSON, A. DRUIN, C. PLAISANT, M. BEAUDOUIN-LAFON, S. CONVERSY, H. EVANS, H. HANSEN, N. ROUSSEL, B. EIDERBÄCK, S. LINDQUIST, Y. SUNDBLAD. *Technology Probes: Inspiring Design for and with Families*, in "Proceedings of ACM CHI 2003 Conference on Human Factors in Computing Systems", CHI Letters, ACM Press, 2003, vol. 5(1), p. 17-24, http://doi.acm.org/10.1145/642611.642616.

[5] W. MACKAY, C. APPERT, M. BEAUDOUIN-LAFON, O. CHAPUIS, Y. DU, J.-D. FEKETE, Y. GUIARD. *TouchStone: Exploratory Design of Experiments*, in "Proceedings of ACM CHI 2007 Conference on Human Factors and Computing Systems", ACM Press, April 2007, p. 1425-1434, http://doi.acm.org/10.1145/1240624.1240840, http://hal.archives-ouvertes.fr/inria-00538384.

[6] E. PIETRIGA, O. BAU, C. APPERT. *Representation-Independent In-Place Magnification with Sigma Lenses*, in "IEEE Transactions on Visualization and Computer Graphics", 2010, vol. 16, n° 1, p. 455-467, http://hal.inria.fr/inria-00467658, http://hal.inria.fr/inria-00467658.

[7] E. PIETRIGA, C. BIZER, D. KARGER, R. LEE. *Fresnel - A Browser-Independent Presentation Vocabulary for RDF*, in "Lecture Notes in Computer Science (LNCS 4273), Proceedings of the 5th International Semantic Web Conference (ISWC 2006)", Springer, November 2006, p. 158-171, http://dx.doi.org/10.1007/11926078_12.

[8] A. ROUDAUT, S. HUOT, E. LECOLINET. *TapTap and MagStick: Improving One-Handed Target Acquisition on Small Touch-screens*, in "Proceedings of AVI'08, the 9th International Working Conference on Advanced Visual Interfaces", ACM Press, May 2008, p. 146-153, http://doi.acm.org/10.1145/1385569.1385594.

[9] A. TABARD, W. MACKAY, N. ROUSSEL, C. LETONDAL. *PageLinker: Integrating Contextual Bookmarks into a Browser*, in "Proceedings of ACM CHI 2007 Conference on Human Factors and Computing Systems", ACM Press, April 2007, p. 337–346, http://doi.acm.org/10.1145/1240624.1240680.

[10] T. TSANDILAS, C. LETONDAL, W. MACKAY. *Musink: Composing Music through Augmented Drawing*, in "CHI '09: Proceedings of the SIGCHI conference on Human factors in computing systems", ACM, 2009, p. 819–828, http://doi.acm.org/10.1145/1518701.1518827.

Year Publications

Doctoral Dissertations and Habilitation Theses

[11] O. BAU. *Interaction streams: helping users learn, execute and remember expressive interaction grammars*, Univ Paris-Sud, Orsay, France, Juin 2010, Thèse de Doctorat.

[12] G. BESACIER. *Interactions Post-WIMP et applications existantes sur une table interactive*, Univ Paris-Sud, Orsay, France, Novembre 2010, Thèse de Doctorat.

Articles in International Peer-Reviewed Journal

[13] E. PIETRIGA, O. BAU, C. APPERT. *Representation-Independent In-Place Magnification with Sigma Lenses*, in "IEEE Transactions on Visualization and Computer Graphics", 2010, vol. 16, n° 1, p. 455-467, http://hal.inria.fr/inria-00467658, http://hal.inria.fr/inria-00467658.

[14] Y. RICHE, W. MACKAY. *PeerCare: Supporting Awareness of Rhythms and Routines for Better Aging in Place*, in "Comput. Supported Coop. Work", 2010, vol. 19, n^{o} 1, p. 73–104, http://dx.doi.org/10.1007/s10606-009-9105-z.

Articles in National Peer-Reviewed Journal

[15] C. APPERT. *Augmenter la validité des évaluations des applications graphiques interactives*, in "Journal Technique et Science Informatiques", 2010, p. 11–29, http://hal.archives-ouvertes.fr/inria-00538335/.

International Peer-Reviewed Conference/Proceedings

[16] C. APPERT, O. BAU. *Scale Detection for a priori Gesture Recognition*, in "CHI '10: Proceedings of the SIGCHI conference on Human factors in computing systems", ACM, 2010, p. 879–882, http://doi.acm.org/10.1145/1753326.1753456, http://hal.archives-ouvertes.fr/inria-00538339.

[17] C. APPERT, O. CHAPUIS, E. PIETRIGA. *High-precision Magnification Lenses*, in "CHI '10: Proceedings of the SIGCHI conference on Human factors in computing systems", ACM, 2010, p. 273–282, http://doi.acm.org/10.1145/1753326.1753366, http://hal.inria.fr/inria-00474022.

[18] B. BACH, G. LEGOSTAEV, E. PIETRIGA. *Visualizing Populated Ontologies with OntoTrix*, in "Proceedings of the ISWC 2010 Posters and Demonstrations Track: Collected Abstracts", CEUR, November 2010, p. 85-88, http://sunsite.informatik.rwth-aachen.de/Publications/CEUR-WS/Vol-658/, http://hal.archives-ouvertes.fr/inria-00530852.

[19] O. CHAPUIS, N. ROUSSEL. *UIMarks: Quick Graphical Interaction with Specific Targets*, in "UIST '10: Proceedings of the 23rd annual ACM symposium on User interface software and technology", ACM, October 2010, p. 173–182, http://doi.acm.org/10.1145/1866029.1866057, http://hal.archives-ouvertes.fr/inria-00533398.

[20] F. CHEVALIER, S. HUOT, J.-D. FEKETE. *WikipediaViz: Conveying Article Quality for Casual Wikipedia Readers*, in "Proceedings of PacificVis '10: IEEE Pacific Visualization Symposium", IEEE, March 2010, p. 49-56, http://dx.doi.org/10.1109/PACIFICVIS.2010.5429611.

[21] T. TSANDILAS, W. MACKAY. *Knotty Gestures: Subtle Traces to Support Interactive Use of Paper*, in "AVI '10: Proceedings of the Working Conference on Advanced Visual Interfaces", ACM, 2010, p. 147–154, http://doi.acm.org/10.1145/1842993.1843020.

[22] J. WAGNER, W. MACKAY. *Exploring Sustainable Design with Reusable Paper*, in "CHI '10: Proceedings of the SIGCHI conference on Human factors in computing systems", ACM, 2010, p. 1871–1874, http://doi.acm.org.gate6.inist.fr/10.1145/1753326.1753606.

[23] J. ZIGELBAUM, A. BROWNING, D. LEITHINGER, O. BAU, H. ISHII. *g-stalt: a chirocentric, spatiotemporal, and telekinetic gestural interface*, in "TEI '10: Proceedings of the 4th International Conference on Tangib le and Embedded Interaction", ACM, 2010, p. 261–264, http://doi.acm.org/10.1145/1709886.1709939.

National Peer-Reviewed Conference/Proceedings

[24] F. CHEVALIER, S. HUOT, J.-D. FEKETE. *Visualisation de mesures agrégées pour l'estimation de la qualité des articles Wikipedia*, in "Proceedings of EGC 2010: Conférence Internationale Francophone sur l'Extraction

et la Gestion des Connaissances, Revue des Nouvelles Technologies de l'Information RNTI-E-??", Cépaduès-Éditions, Janvier 2010, p. 351-362, http://www.aviz.fr/wikipediaviz/wikipediaviz_EGC-2010.pdf.

[25] G. FAURE, O. CHAPUIS, M. BEAUDOUIN-LAFON. *Perception de la profondeur en gestion des fenêtres*, in "IHM '10: Proceedings of the 22th International Conference of the Association Francophone d'Interaction Homme-Machine", ACM, 2010, p. 149–152, http://hal.archives-ouvertes.fr/hal-00533522.

Workshops without Proceedings

[26] E. GHOMI, O. BAU, W. MACKAY, S. HUOT. *Conception et apprentissage des interactions tactiles: le cas des postures multi-doigts*, in "FITG '10: French workshop on tactile and gestural interaction", juin 2010, http://fitg10.lille.inria.fr/workshop-data/proposals/ghomi-et-al.pdf.

Books or Proceedings Editing

[27] C. HUNDHAUSEN, E. PIETRIGA, P. DÍAZ, M. ROSSON (editors). *Proceedings of the 2010 Symposium on Visual Languages and Human-Centric Computing*, IEEE Computer Society, September 2010, 276 pages.

Research Reports

[28] O. BAU, E. GHOMI, W. MACKAY. *Arpege: Design and Learning of multi-finger chord gestures*, LRI, Univ Paris-Sud, France, Février 2010, n^{o} 1533, 23 pages, Technical report, http://www.lri.fr/~bibli/Rapports-internes/2010/RR1533.pdf.

References in notes

[29] C. APPERT, S. HUOT, P. DRAGICEVIC, M. BEAUDOUIN-LAFON. *FlowStates: Prototypage d'applications interactives avec des flots de données et des machines à états*, in "Proceedings of IHM 2009, 21ème conférence francophone sur l'Interaction Homme-Machine", ACM, Octobre 2009, p. 119-128, Best paper award, http://doi.acm.org/10.1145/1629826.1629845.

[30] O. BAU, W. MACKAY. *OctoPocus: A Dynamic Guide for Learning Gesture-Based Command Sets*, in "Proceedings of ACM Symposium on User Interface Software and Technology (UIST 2008)", Monterey, CA, ACM, October 2008, p. 37-46, http://doi.acm.org/10.1145/1449715.1449724.

[31] M. BEAUDOUIN-LAFON. *Instrumental interaction: an interaction model for designing post-WIMP user interfaces*, in "Proc. ACM Conference on Human Factors in Computing Systems (CHI 2000)", CHI Letters, ACM, 2000, vol. 2(1), p. 446–453, http://doi.acm.org/10.1145/332040.332473.

[32] M. BEAUDOUIN-LAFON. *Designing interaction, not interfaces*, in "Proc. Conference on Advanced Visual Interfaces, AVI 2004", Gallipoli (Italy), ACM Press, May 2004, p. 15–22, Invited keynote address, http://doi.acm.org/10.1145/989863.989865.

[33] O. CHAPUIS, R. BLANCH, M. BEAUDOUIN-LAFON. *Fitts' Law in the Wild: A Field Study of Aimed Movements*, LRI, Univ Paris-Sud, France, 2007, n^{o} 1480, 11 pages, Technical report, http://insitu.lri.fr/~chapuis/publications/RR1480.pdf.

[34] O. CHAPUIS. *Gestion des fenêtres : enregistrement et visualisation de l'interaction*, in "Proceedings of IHM 2005, 17ème conférence francophone sur l'Interaction Homme-Machine", ACM, Septembre 2005, p. 255-258, http://doi.acm.org/10.1145/1148550.1148590.

[35] O. CHAPUIS, N. ROUSSEL. *Metisse is not a 3D desktop!*, in "Proceedings of UIST'05, the 18th ACM Symposium on User Interface Software and Technology", ACM, 2005, p. 13-22, http://doi.acm.org/10.1145/1095034.1095038.

[36] O. CHAPUIS, N. ROUSSEL. *Copy-and-Paste Between Overlapping Windows*, in "Proceedings of ACM CHI 2007 Conference on Human Factors and Computing Systems", ACM, 2007, p. 201–210, http://doi.acm.org/10.1145/1240624.1240657.

[37] P. DRAGICEVIC, J.-D. FEKETE. *Support for input adaptability in the ICON toolkit*, in "Proc. ICMI'04", ACM, 2004, p. 212–219, http://doi.acm.org/10.1145/1027933.1027969.

[38] G. FAURE, O. CHAPUIS, N. ROUSSEL. *Power tools for copying and moving: useful stuff for your desktop*, in "CHI '09: Proceedings of the SIGCHI conference on Human factors in computing systems", ACM, 2009, p. 1675–1678, http://doi.acm.org/10.1145/1518701.1518958.

[39] C. N. KLOKMOSE, M. BEAUDOUIN-LAFON. *VIGO: Instrumental Interaction in Multi-Surface Environments*, in "CHI '09: Proceedings of the SIGCHI conference on Human factors in computing systems", ACM, 2009, p. 869–878, http://doi.acm.org/10.1145/1518701.1518833.

[40] E. PIETRIGA. *A Toolkit for Addressing HCI Issues in Visual Language Environments*, in "IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC'05)", September 2005, p. 145–152, http://doi.ieeecomputersociety.org/10.1109/VLHCC.2005.11.

[41] J. REKIMOTO. *Pick-and-drop: a direct manipulation technique for multiple computer environments*, in "Proceedings of the 10th annual ACM symposium on User interface software and technology", New York, NY, USA, UIST '97, ACM, 1997, p. 31–39, http://doi.acm.org/10.1145/263407.263505.

[42] W. STUERZLINGER, O. CHAPUIS, D. PHILLIPS, N. ROUSSEL. *User Interface Façades: Towards Fully Adaptable User Interfaces*, in "Proceedings of UIST'06, the 19th ACM Symposium on User Interface Software and Technology", ACM, 2006, p. 309-318, http://doi.acm.org/10.1145/1166253.1166301.