



Activity Report 2011

**Team MINT**

Methods and tools for gestural interactions

RESEARCH CENTER  
Lille - Nord Europe

THEME  
Interaction and Visualization



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# Team MINT

**Keywords:** Interaction, Real-Time, User Interface

*Created in January 2010, **Mint** is a collaboration between **Inria Lille**, the **LIFL** and **L2EP** labs of **Lille 1 University**, and **CNRS** (Centre National de la Recherche Scientifique).*

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## 2. Overall Objectives

### 2.1. Overall Objectives

The Mint team focuses on *gestural interaction*, i.e. the use of gesture for human-computer interaction (HCI). The New Oxford American Dictionary defines *gesture* as *a movement of part of the body, especially a hand or the head, to express an idea or meaning*. In the particular context of HCI, we are more specifically interested in movements that a computing system can sense and respond to. A gesture can thus be seen as a function of time into a set of sensed dimensions that might include but are not limited to positional information (the pressure exerted on a contact surface being an example of non-positional dimension).

Simple pointing gestures have long been supported by interactive graphics systems and the advent of robust and affordable sensing technologies has somewhat broadened their use of gestures. Swiping, rotating and pinching gestures are now commonly supported on touch-sensitive devices, for example. Yet the expressive power of the available gestures remains limited. The increasing diversity and complexity of computer-supported activities calls for more powerful gestural interactions. Our goal is to foster the emergence of these new interactions, to further broaden the use of gesture by supporting more complex operations. We are developing the scientific and technical foundations required to facilitate the design, implementation and evaluation of these interactions. Our interests include:

- gestures captured using held, worn or touched objects or contactless perceptual technologies;
- transfer functions possibly used during the capture process;
- computational representations of the captured gestures;
- methods for characterizing and recognizing them;
- feedback mechanisms, and more particularly haptic ones;
- tools to facilitate the design and implementation of tactile and gestural interaction techniques;
- evaluation methods to assess the usability of these techniques.

### 2.2. Highlights

- S. Degrande received a “**Crystal**” award from CNRS, a distinction attributed every year to technical staff members whose original and inventive contributions benefit a body of professionals beyond the confines of a single laboratory or department;
- G. Casiez, N. Roussel, R. Vanbelleghem and F. Giraud’s paper on the Surfpad pointing facilitation technique [17] received an *honorable mention* award (top 5% of the 1540 submissions) from the **ACM CHI 2011** conference;
- M. Amberg, F. Giraud, B. Lemaire-Semail, P. Olivo, G. Casiez and N. Roussel’s demo of the STIMTAC [15] received the second place award for best demo from the **ACM UIST 2011** conference attendees;
- B. Lemaire-Semail, M. Amberg, F. Giraud, N. Roussel and P. Olivo’s work on the 3D TOUCH project received a “5 stars” label from STMicroelectronics’ Core Innovation Team;
- L. Grisoni, N. Bremard and S. Degrande collaborated with artists Alexandre Maubert and Léonore Mercier on Monade and Damassama, two interactive pieces shown at **Le Fresnoy’s Panorama 13** exhibition;
- N. Bremard, J. Gilliot, L. Grisoni, D. Marchal, C. Moerman, P. Olivo, Y. Rekik, N. Roussel and D. Selosse visited 38 college and high school classes during the “Fête de la Science” (October 10-14, about 900 students);
- About 200 researchers, artists, practitioners and enthusiasts participated in **FITG II + ArtLab**, an open event co-organized by N. Roussel and C. Chaillou in cooperation with Pôle Images (September 22-23);
- T. Pietrzak joined the team in September 2011 after a PhD at the University of Metz and post-doctoral stays at Telecom ParisTech (INFRES, IC2/VIA) and the University of Toronto (DGP).

BEST PAPER AWARD :

[17] *Proceedings of CHI 2011*. G. CASIEZ, N. ROUSSEL, R. VANBELLEGHEM, F. GIRAUD.

## 3. Scientific Foundations

### 3.1. Human-Computer Interaction

The scientific approach that we follow considers user interfaces as means, not an end: our focus is not on interfaces, but on interaction considered as a phenomenon between a person and a computing system [27]. We *observe* this phenomenon in order to understand it, i.e. *describe* it and possibly *explain* it, and we look for ways to significantly *improve* it. HCI borrows its methods from various disciplines, including Computer Science, Psychology, Ethnography and Design. Participatory design methods can help determine users' problems and needs and generate new ideas, for example [34]. Rapid and iterative prototyping techniques allow to decide between alternative solutions [28]. Controlled studies based on experimental or quasi-experimental designs can then be used to evaluate the chosen solutions [36]. One of the main difficulties of HCI research is the doubly changing nature of the studied phenomenon: people can both adapt to the system and at the same time adapt it for their own specific purposes [33]. As these purposes are usually difficult to anticipate, we regularly *create* new versions of the systems we develop to take into account new theoretical and empirical knowledge. We also seek to *integrate* this knowledge in theoretical frameworks and software tools to disseminate it.

### 3.2. Numerical and algorithmic real-time gesture analysis

Whatever is the interface, user provides some curves, defined over time, to the application. The curves constitute a gesture (positionnal information, yet may also include pressure). Depending on the hardware input, such a gesture may be either continuous (e.g. data-glove), or not (e.g. multi-touch screens). User gesture can be multi-variate (several fingers captured at the same time, combined into a single gesture, possibly involving two hands, maybe more in the context of co-located collaboration), that we would like, at higher-level, to be structured in time from simple elements in order to create specific command combinations.

One of the scientific fundations of the research project is an algorithmic and numerical study of gesture, which we classify into three points:

- *clustering*, that takes into account intrinsic structure of gesture (multi-finger/multi-hand/multi-user aspects), as a lower-level treatment for further use of gesture by application;
- *recognition*, that identifies some semantic from gesture, that can be further used for application control (as command input). We consider in this topic multi-finger gestures, two-handed gestures, gesture for collaboration, on which very few has been done so far to our knowledge. On the contrary, in the case of single gesture case (i.e. one single point moving over time in a continuous manner), numerous studies have been proposed in the current literature, and interestingly, are of interest in several communities: HMM [37], Dynamic Time Warping [39] are well-known methods for computer-vision community, and hand-writing recognition. In the computer graphics community, statistical classification using geometric descriptors has previously been used [35]; in the Human-Computer interaction community, some simple (and easy to implement) methods have been proposed, that provide a very good compromise between technical complexity and practical efficiency [38].
- *mapping to application*, that studies how to link gesture inputs to application. This ranges from transfer function that is classically involved in pointing tasks [31], to the question to know how to link gesture analysis and recognition to the algorithmic of application content, with specific reference examples.

We ground our activity on the topic of numerical algorithm, expertise that has been previously achieved by team members in the physical simulation community (within which we think that aspects such as elastic deformation energies evaluation, simulation of rigid bodies composed of unstructured particles, constraint-based animation... will bring up interesting and novel insights within HCI community).

### 3.3. Design and control of haptic devices

Our scientific approach in the design and control of haptic devices is focused on the interaction forces between the user and the device. We search of controlling them, as precisely as possible. This leads to different designs compared to other systems which control the deformation instead. The research is carried out in three steps:

- *identification*: we measure the forces which occur during the exploration of a real object, for example a surface for tactile purposes. We then analyze the record to deduce the key components – *on user's point of view* – of the interaction forces.
- *design*: we propose new designs of haptic devices, based on our knowledge of the key components of the interaction forces. For example, coupling tactile and kinesthetic feedback is a promising design to achieve a good simulation of actual surfaces. Our goal is to find designs which leads to compact systems, and which can stand close to a computer in a desktop environment.
- *control*: we have to supply the device with the good electrical conditions to accurately output the good forces.

## 4. Application Domains

### 4.1. Next-generation desktop systems

The term *desktop system* refers here to the combination of a window system handling low-level graphics and input with a window manager and a set of applications that share a distinctive look and feel. It applies not only to desktop PCs but also to any other device or combination of devices supporting graphical interaction with multiple applications. Interaction with these systems currently rely on a small number of interaction primitives such as text input, pointing and activation as well as a few other basic gestures. This limited set of primitives is one reason the systems are simple to use. There is, however, a cost. Most simple combinations being already used, few remain to trigger and control innovative techniques that could facilitate task switching or data management, for example. Desktop systems are in dire need of additional interaction primitives, including gestural ones.

### 4.2. Ambient Intelligence

*Ambient intelligence* (AmI) refers to the concept of being surrounded by intelligent systems embedded in everyday objects [32]. Envisioned AmI environments are aware of human presence, adapt to users' needs and are capable of responding to indications of desire and possibly engaging in intelligent dialogue. Ambient Intelligence should be unobtrusive: interaction should be relaxing and enjoyable and should not involve a steep learning curve. Gestural interaction is definitely relevant in this context.

### 4.3. Serious Games

Serious game refers to techniques extensively used in computer games, that are being used for other purposes than gaming. Fields such as learning, use of Virtual Reality for rehabilitation, 3D interactive worlds for retail, art-therapy, are specific context with which the MINT group has scientific connection, and industrial contacts. This field of application is a good opportunity for us to test and transfer our scientific knowledge and results.

### 4.4. Interactive Art

The heart of Mint project is about interaction gesture, and aims at making relation between application and user more intimate through the production of tools and methods for application to use more information from user gesture. There seems to be, at first sight, very strong difference of fields, tools, vocabulary, between Science and Art. Up to basic intellectual schemes are classically thought to be different. Yet, a closer look needs to be taken on things. Through time, Art is more and more involved in relation between people and content. For example, *relational art*<sup>1</sup> is centered on inter-human relations and social context. Because of this similar analysis about relation between person and content, research on interactive systems probably has a lot to develop relations with Art, this is also true for research on gestural interaction.

<sup>1</sup>[http://en.wikipedia.org/wiki/Relational\\_Art](http://en.wikipedia.org/wiki/Relational_Art)



## 5. Software

### 5.1. LibGINA

**Participant:** Laurent Grisoni [correspondant].

This library has been developed within the context of the ADT GINA, for one of the installation that have been made in collaboration with Le Fresnoy national studio (Damassama, Léonore Mercier). This library is currently being posted as APP, and has been used by Idées-3com small company, in the context of our join I-lab program. This library allows for use of gesture for command, and is able to handle strong variability into recognized patterns.

Current version: version 1.0

**Software characterization:** A-2 SO-3 SM-2-up EM-3 SDL-3 OC-DA4-CD4-MS2-TPM4

### 5.2. 3D interaction using mobile phone

**Participants:** Samuel Degrande [correspondant], Laurent Grisoni.

This work has been achieved in the context of the Idées-3com I-lab. In this context a module, that allows to use any android based smartphone to control an Explorer module for navigation and interaction with VRML-based content. This module was used as a basis by Idées-3com in their commercial product this year.

Current version: version 1.0

**Software characterization:** A-2 SO-3 SM-2-up EM-2-up SDL-3 OC-DA4-CD4-MS2-TPM4

### 5.3. tIO (tactile input & output)

**Participants:** Paolo Olivo, Nicolas Roussel [correspondant].

tIO is a library designed to facilitate the implementation of doubly tactile interaction techniques (tactile input coupled with tactile feedback) based on the STIMTAC technology. Supporting all current STIMTAC prototypes, it makes it easy to move the system pointer of the host computer according to motions detected on them and adapt their vibration amplitude based on the color of the pointed pixel or the nature of the pointed object. The library includes a set of Qt demo applications that illustrate these two different approaches and makes it easy to “augment” existing Qt applications with tactile feedback. It also makes it possible to supplement or substitute tactile feedback with basic auditory feedback synthesized using **portaudio** (friction level is linearly mapped to the frequency of a sine wave). This not only facilitates the development and documentation of tactile-enhanced applications but also makes it easier to demonstrate them to a large audience.

Current version: 0.1 - June 2011 (IDDN.FR.001.270005.000.S.P.2011.000.10000)

**Software characterization:** A2, SO3-up, SM-2, EM2, SDL1.

### 5.4. libpointing

**Participants:** Géry Casiez [correspondant], Damien Marchal, Nicolas Roussel.

Libpointing is a software toolkit that provides direct access to HID pointing devices and supports the design and evaluation of pointing transfer functions [16]. The toolkit provides resolution and frequency information for the available pointing and display devices and makes it easy to choose between them at run-time through the use of URIs. It allows to bypass the system’s transfer functions to receive raw asynchronous events from one or more pointing devices. It replicates as faithfully as possible the transfer functions used by Microsoft Windows, Apple OS X and Xorg (the X.Org Foundation server). Running on these three platforms, it makes it possible to compare the replicated functions to the genuine ones as well as custom ones. The toolkit is written in C++ with Python and Java bindings available. It is scheduled to be publicly released in 2012, the licence remaining to be decided.

Web site: <http://libpointing.org/>

Software characterization: A3, SO3, SM-2, EM2, SDL4

## 6. New Results

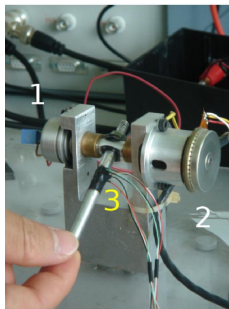
### 6.1. Improvement of the force-feedback in a 1-ddl device

**Participants:** Michel Amberg, Frédéric Giraud, Betty Lemaire-Semail.

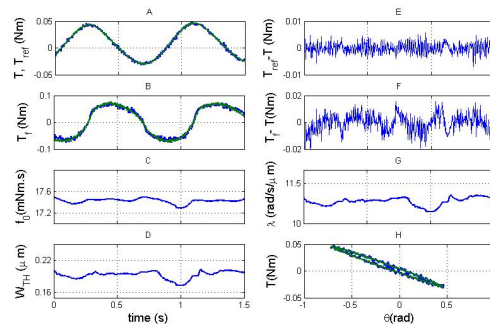
Traveling Wave Ultrasonic Motor have many advantages compared to the classical electromagnetic motors: they are lightweight, they don't need any speed reducer and they make no noise. In a 1-ddl force feedback device, they can help to reduce the bulk size of the mechanism by simplifying the kinematic chain. However, their control has to be very precise because the torque produced is not a straightforward function of the electrical parameters. Previously, we proposed several control algorithms and we obtained good results. But at low speed, problems still remains, like a stick-slip phenomena which makes the motor producing a cogging torque.

To cope with this problem, we first proposed an accurate modeling of the motor and its torque production [24]. We introduced a friction torque  $T_f$  which holds the non linearity of the torque production. The evolution of this friction torque has been identified through an experimental study. Then we obtained by inversion a control scheme [13]. The basic idea is to compensate the virtual friction torque. In order to achieve a more accurate control of the torque, we proposed to identify *on-line* the parameters of the equation of  $T_f$ .

A one-degree-of-freedom force feedback lever was built to verify the control laws. The experiment involves use of the lever of the digitracker which is free to rotate about the horizontal axis, and is presented in figure 1. In the same figure, we plotted the output torque of the motor, compared to its reference. Both are consistent, showing a good accuracy of the torque controller. To achieve that, the estimator's parameters are time-varying.



(a)



(b)

Figure 1. (a) The 1-ddl haptic device; (b) experimental run of the torque controller with its parameter estimator; in H, results are plotted in the Torque-position plane, reference is in green and measurements is in blue while C, D and G show the estimator's parameters

### 6.2. Haptic Perception of Curvature through active touch

**Participants:** Michel Amberg, Frédéric Giraud, Betty Lemaire-Semail.

Haptic perception of curvature can be achieved by passive or active finger touch. In this study we proposed a new haptic device that could independently orient, elevate and translate a flat plate. User is free to move his finger on the plate; by controlling plate's orientation and position accordingly to the position of the finger, we can render a curved shape. The device is composed of two 6-dof haptic devices (Novint Falcon) on which we attached the plate (Figure 2). A force sensor is used to compute the position of the finger on the plate.

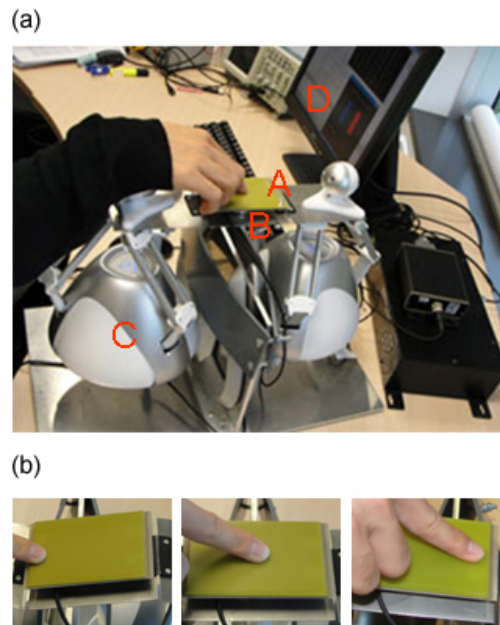


Figure 2.

Several modelings have been proposed to calculate the orientation and position of the plate. We then measured how accurate simulations of curved shapes are. To achieve that work, we simulated several curved surfaces with different curvature. As the perception performance of curvature is dependent on local surface orientation, the plate was always kept tangent to a virtual shape at the contact point. We then asked people to compare simulated curvature to the real ones. We found that users are able to find the real shape (among five) corresponding to the simulated one [21].

### 6.3. Tactile input with programmable friction

**Participants:** Michel Amberg, Géry Casiez, Frédéric Giraud, Betty Lemaire-Semail, Paolo Olivo, Nicolas Roussel.

Our work on programmable friction relies on a particular technology we have been developing for several years. The STIMTAC is a touchpad device that supports friction reduction by means of a *squeeze film effect* [29]. It uses a controlled vibration at an ultrasonic frequency with a few micrometers amplitude to create an air bearing between a user's finger and the device's surface. As the frequency is outside skin mechanoreceptors' bandwidth, one does not feel this vibration but its effect on tribological contact mechanisms: the touchpad feels more slippery as the amplitude is raised.

We have used this touchpad to create *Surfpad*, a pointing facilitation technique that operates in the tactile domain. Experiments comparing this technique to *semantic pointing* [30] and constant control-display gain with and without distractor targets clearly show the limits of traditional target-aware control-display gain adaptation in the latter case, and the benefits of the tactile approach in both cases [17]. *Surfpad* leads to a performance improvement close to 9% compared to unassisted pointing at small targets with no distractor. It is also robust to high distractor densities, keeping an average performance improvement of nearly 10% while semantic pointing can degrade up to 100%. Our results also suggest the performance improvement is caused by tactile information feedback rather than mechanical causes, and that the feedback is more effective when friction is increased on targets using a simple step function.

This year's work on the hardware aspects of the STIMTAC resulted in a compact and quiet prototype powered by the USB cable used for data communication and supporting precise and reliable finger tracking based on multiple force sensors (Figure 3, left). Within the context of the 3D TOUCH project, efforts have also been targeted at the adaptation of the STIMTAC operating principles to off-the-shelf transparent touch sensors. Our latest prototypes demonstrate the compatibility of our approach with resistive (Figure 3, right) and capacitive technologies. In order to facilitate the design and evaluation of novel interaction techniques taking advantage of these prototypes, we have started developing a specific library, *tIO*, that supports all of them in a unified way.



Figure 3. Compact opaque STIMTAC and transparent resistive prototype

## 6.4. Methods and tools to characterize, replicate and compare pointing transfer functions

**Participants:** Géry Casiez, Damien Marchal, Nicolas Roussel.

Transfer functions are the only pointing facilitation technique actually used in modern graphical interfaces involving the indirect control of an on-screen cursor. But despite their general use, very little is known about them. We developed *EchoMouse*, a device we created to characterize the transfer functions of any system, and *libpointing*, a toolkit that we developed to replicate and compare the ones used by Windows, OS X and Xorg [16]. We described these functions and reported on an experiment that compared the default one of the three systems. Our results show that these default functions improve performance up to 24% compared to a unitless constant CD gain. We also found significant differences between them, with the one from OS X improving performance for small target widths but reducing its performance up to 9% for larger ones compared to Windows and Xorg. These results notably suggest replacing the constant CD gain function commonly used by HCI researchers by the default function of the considered systems.

## 6.5. Multimodal pen input for interactive multitouch surfaces

**Participant:** Géry Casiez.

Touch interaction is arguably more immediate and natural in many situations, but fingers are imprecise and difficult to write with. Alternatively, using a pen (or stylus) makes writing more natural and pointing more precise. Luckily, this does not need to be a unilateral choice; pen and touch can be used simultaneously. However, without non-dominant hand coordination or graphical buttons, the pen itself supports few modes. This makes single-handed mobile usage difficult and reduces the number of combined touch and pen modes. When frequently switching between pen-oriented modes, such as drawing, handwriting, gestures, and lasso selection, this can hurt performance. Inferring modes is difficult, and most users prefer explicit control. Schemes for squeezing multiple explicit modes from a pen include adding barrel buttons and classifying pressure, tilt, barrel rotation, or grip. But these can be error-prone and ambiguous. A simple way to add a second mode is by adding an “eraser,” a second contact point. The pencil analogy lends intuition and users have explicit control.

Conté is a small input device inspired by the way artists manipulate a real Conté crayon. By changing which corner, edge, end, or side is contacting the display, the operator can switch interaction modes using a single hand. Conté’s rectangular prism shape enables both precise pen-like input and tangible handle interaction. Conté also has a natural compatibility with multi-touch input: it can be tucked in the palm to interleave same-hand touch input, or used to expand the vocabulary of bimanual touch. Inspired by informal interviews with artists, we catalogue Conté’s characteristics, and use these to outline a design space. We describe a prototype device using common materials and simple electronics. With this device, we demonstrate interaction techniques in a test-bed drawing application [19].

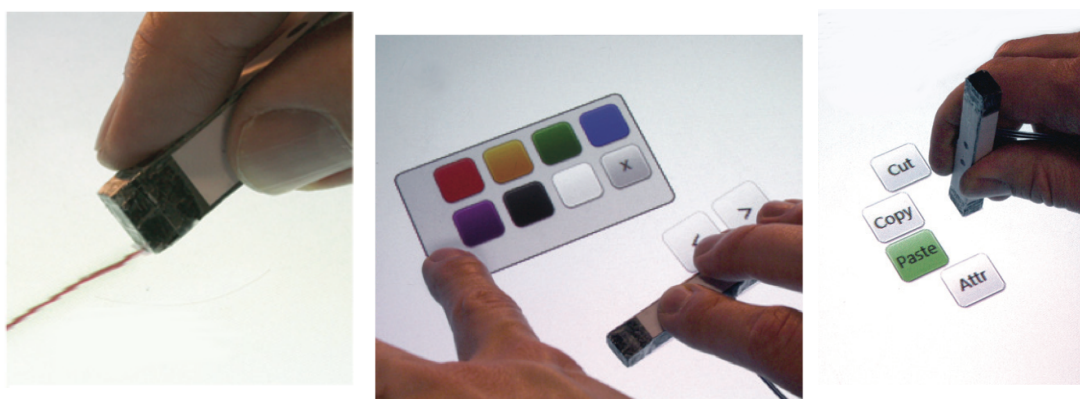


Figure 4. Illustration of different modes defined by Conté: (left) freehand drawing and annotating with the corner; (middle) revealing attribute palettes using a thick side face; (right) contextual commands using the end contact.

## 6.6. Perceived difficulty of pen gestures

**Participants:** Géry Casiez, Laurent Grisoni.

There are three primary factors which contribute to a successful gesture-based interface: the acquisition technology, the recognizer, and the design of the gesture set. Technologies to acquire gestures, and gesture recognition algorithms, are now quite robust and widely available. However, developing techniques and criteria to help designers create an intuitive and easy-to-perform gesture set remain an active area of research. The challenge is that in order to successfully integrate into an application, a gesture has to satisfy multiple criteria:

it must be unambiguously recognized; fit well with its associated function; be easy to learn and recall; and be efficient to perform.

Our empirical results show that users perceive the execution difficulty of single stroke gestures consistently, and execution difficulty is highly correlated with gesture production time. We use these results to design two simple rules for estimating execution difficulty: establishing the relative ranking of difficulty among multiple gestures; and classifying a single gesture into five levels of difficulty. We confirm that the CLC model does not provide an accurate prediction of production time magnitude, and instead show that a reasonably accurate estimate can be calculated using only a few gesture execution samples from a few people. Using this estimated production time, our rules, on average, rank gesture difficulty with 90% accuracy and rate gesture difficulty with 75% accuracy. Designers can use our results to choose application gestures, and researchers can build on our analysis in other gesture domains and for modeling gesture performance [18].

## 7. Contracts and Grants with Industry

### 7.1. Contracts with Industry

#### 7.1.1. *I-Lab Idées-3com (2009-2012)*

**Participants:** Clément Moerman, Norbert Barichard, Samuel Degrande, Patricia Plénacoste, Damien Marchal, Laurent Grisoni [correspondant].

We have set up with Idées-3com small company a join research program, targeted toward new tools for retail. This program is supported by INRIA, with a 3 year young engineer contract. During this join project, we have proposed interaction systems that is based on mobile phone, and allows fast navigation into 3D virtual world. We also recently proposed a new navigation technique, that proposes nice properties, including fast and accurate control of transition position during navigation.

#### 7.1.2. *3D TOUCH (STMicroelectronics, 2010-2011)*

**Participants:** Michel Amberg, Géry Casiez, Frédéric Giraud, Betty Lemaire-Semail [correspondant], Paolo Olivo, Nicolas Roussel.

The goal of this project was to study the adaptation of the operating principles of the STIMTAC (i.e. piezoelectric cells bonded to a mechanical resonator) to off-the-shelf transparent touch sensors based on resistive and capacitive technologies.

## 8. Partnerships and Cooperations

### 8.1. Regional Initiatives

#### 8.1.1. *Gina (Inria ADT, 2009-2011)*

**Participants:** Nicolas Bremard, Samuel Degrande, Laurent Grisoni [correspondant], Damien Marchal.

This technology development activity aims at proposing a low-cost free-hand interaction system, that can be used flexibly in arbitrary configuration, using previous team results (start oct 2009, end nov 2011). During both years of this ADT, collaboration has been made with Le Fresnoy (National Studio of Contemporary Art) School (<http://www.lefresnoy.net>), for the *Panorama* exhibitions (one month, from early june to early july each year). Each year, two artistic installation have been put up in collaboration with artists from this school; in 2010-2011, the two installation used a kinect as the acquisition device for interaction.

#### 8.1.2. *Boing (Inria ADT, 2010-2012)*

**Participants:** Damien Marchal, Paolo Olivo, Nicolas Roussel [correspondant].

This project aims at creating a software toolkit to facilitate research on tactile and gestural interaction with the following goals in mind: it should make it easy to handle different hardware and software configurations, to compare existing interaction techniques, to develop new ones and to make them available to other people. See [23] for a description of the motivation for this work and preliminary results.

## 8.2. National Initiatives

### 8.2.1. *Reactive (ANR TecSan, 2008-2011)*

**Participants:** Géry Casiez, Jean-Philippe Deblonde, Frédéric Giraud, Laurent Grisoni [correspondant].

This project addressed rehabilitation for patients who suffered cerebrovascular accident (CVA). It aimed at proposing new VR-based tools for rehabilitation to improve patient involvement into his/her own rehabilitation, by proposing attractive training exercises and increase transfer of recovered skills, from exercises to real-life situations[14].

Partners: Hopale Foundation (coordinator), Inria [Mint], CEA-LIST, Idées-3com

Web site: <http://reactive.berck-handicap.com/>

### 8.2.2. *InSTInCT (ANR ContInt, 2009-2012)*

**Participants:** Géry Casiez [correspondant], Frédéric Giraud, Laurent Grisoni, Anthony Martinet, Nicolas Roussel.

This project focuses on the design, development and evaluation of new simple and efficient touch-based interfaces, with the goal of bringing widespread visibility to new generations of interactive 3D applications.

Partners: Inria [Mint, Iparla], Immersion, Cap Sciences

Web site: <http://anr-instinct.cap-sciences.net/>

## 8.3. European Initiatives

### 8.3.1. *SHIVA (InterReg II-Seas, 2010-2013)*

**Participants:** Fabrice Aubert, Géry Casiez, Samuel Degrande, Laurent Grisoni [correspondant], Damien Marchal, Yosra Rekik, Nicolas Roussel.

This project aims at providing virtual reality-based tools for sculpting, targeted on virtual rehabilitation, and children with disabilities. Sculpting was traditionally used within medical context, and has been removed because of practical cost, and also hygienic aspects. In this project, we plan to built up tools for virtual sculpting through adapted interface, and propose a set of exercises that would involved cognitive skills of user (assembly, object reproduction, boolean operations, etc.).

Partners: Inria [Mint, project coordinator], Hopale Foundation, University of Bournemouth, Victoria school in Poole.

Web site: <http://www.lifl.fr/mint/pmwiki.php?n=SHIVA.Php>

## 8.4. International Initiatives

### 8.4.1. *Visits of International Scientists*

- Masaya Takasaki (Saitama University, June 2011)
- Dan Vogel (University of Waterloo, June 2011)
- Bruno De Araujo (University of Lisbon, sept-dec 2011)

## 9. Dissemination

### 9.1. Animation of the scientific community

Invited talks:

- Gestural Interaction in VR: Trends and Applications : L. Grisoni, Todai Forum (organized during the Todai University Visit in france), october 2011, IRCAM (Paris).

**Journal editorial board:**

- **Journal d'Interaction Personne-Système (JIPS)**: N. Roussel (co-editor in chief), G. Casiez

**Journal reviewing:**

- ACM Transactions on Computer-Human Interaction (ToCHI): N. Roussel, G. Casiez
- Computer Aided Design: L. Grisoni
- International Journal of Human Computer Studies (IJHCS): G. Casiez
- Transactions on Ultrasonic Ferroelectricity and Frequency Control (TUFFC): F. Giraud
- Transactions on Mechatronics: F. Giraud
- Control Engineering Practice: F. Giraud

**Conference organization:**

- **FITG II + ArtLab**, the second *Forum on tactile and gestural interaction* (September 22-23, about 200 participants): N. Roussel & C. Chaillou, co-organizers
- Computer Animation and Social Worlds (CASA) 2011: L. Grisoni, Program Committee
- IHM 2011: N. Roussel, long papers chair
- Workshop on Virtual Reality Interaction and Physical Simulation (VRIPHYS) 2011 : L. Grisoni, Program Committee

**Conference reviewing:**

- ACM CHI 2011: N. Roussel, G. Casiez
- ACM UIST 2011: G. Casiez
- ACM CSCW 2011: N. Roussel
- ACM SIGGRAPH : L. Grisoni
- Eurographics STAR : L. Grisoni
- GI 2011: G. Casiez, L. Grisoni
- 3DUI 2011: N. Roussel
- Interact 2011: N. Roussel
- ITS 2011: N. Roussel, G. Casiez
- IHM 2011: G. Casiez
- World Haptics 2011: G. Casiez

**Scientific associations:**

- **AFIHM**, the French speaking HCI association: N. Roussel and T. Pietrzak, members of the Executive Committee (vice-president and secretary since November 2011)
- **RTP Visual Studies** : L. Grisoni, member of the expert group
- ICAVS (International Cluster for Advanced Visual Studies, Plaine Image, Tourcoing): L. Grisoni, member of the scientific committee of this initiative.



**Evaluation committees and invited expertise:**

- AERES (evaluation agency for research and higher education): L. Grisoni, member of a visiting committee (LE2i, Dijon, January 2011); N. Roussel, member of a visiting committee (LCOMS, Metz, December 2011)
- UNIT (engineering and technology digital university) Scientific Committee member: N. Roussel
- ANRT (national board for research and technology): N. Roussel, expert reviewer
- DRRT (regional board for research and technology): N. Roussel, expert reviewer
- Bordeaux I Computer Science hiring committees members: L. Grisoni (professor position)
- Lille 1 Computer Science hiring committees members: L. Grisoni (Vivier animation), G. Casiez, N. Roussel (president, MCF 0484)
- Rennes 1 Computer Science hiring committees members: L. Grisoni, G. Casiez
- JCJC SIMI3 (ANR) : L. Grisoni, expert reviewer
- JCJC SIMI2 (ANR): G. Casiez, expert reviewer
- ANR Blanc Inter II SIMI2: L. Grisoni, expert reviewer
- ANR Contint : L. Grisoni, reviewer
- SIMI 2 (ANR): G. Casiez, expert reviewer
- CNRS PEPH-53 : L. Grisoni, expert reviewer
- Research Foundation Flanders FWO: G. Casiez, expert reviewer

**PhD committees**

- Suzanne Tak (University of Canterbury, December 2011): G. Casiez, reviewer
- Guillaume Faure (Paris-Sud Univ., December 2011): G. Casiez, examiner
- Jonathan Chaboissier (Paris-Sud Univ., December 2011): N. Roussel, examiner
- Jeremy Ringard (Lille 1 Univ., October 2011): C. Chaillou and S. Degrande, co-advisors
- Anthony Martinet (Lille 1 Univ., October 2011): L. Grisoni and G. Casiez, co-advisors
- Benjamin Tissoires (Toulouse Univ., September 2011): N. Roussel, reviewer
- Adriano Scoditti (Grenoble Univ., September 2011): N. Roussel, examiner
- Clément Nadal (Toulouse Univ., July 2011): F. Giraud, examiner
- Sylvain Malacria (Telecom ParisTech, May 2011): G. Casiez, examiner
- Christophe Wiertelwski (UPMC, October 2011): B. Lemaire-Semail reviewer
- Quentin Avril (Rennes, September 2011): L. Grisoni, reviewer

**Scientific mediation:**

- “Fête de la Science”, *touring researchers* initiative (October): N. Bremard, J. Gilliot, L. Grisoni, D. Marchal, C. Moerman, P. Olivo, Y. Rekik, N. Roussel and D. Selosse
- *CS Unplugged* workshops: N. Roussel (Toulouse-Lautrec elementary school, Villeneuve d’Ascq)
- “Forum Départemental des Sciences”, Villeneuve d’Ascq: N. Roussel (debate on the *digital city*, in December)
- “Comptoirs du numériques” presentations, Paris (June): L. Grisoni, N. Roussel
- “*Place de la toile*” radio program, France Culture: N. Roussel (January)
- Workshops and demonstrations at *Inria’s EuraTechnologies Plateau*: L. Grisoni, N. Roussel
- “Rencontres INRIA-Industrie” on the *television of the future* (November): demonstration of contactless gesture-based control by L. Grisoni and N. Bremard
- “Rencontres INRIA-Industrie” on the *health for home and mobility* (November): demonstration of contactless gesture-based control by S. Degrande and L. Grisoni
- “*Journées Recherche Innovation Création*”, Lille 1 Univ. (October): N. Roussel
- Interaction via le geste sans contact: un retour d’expérience sur la collaboration art-science : L. Grisoni, Léonore Mercier, *FITG-ArtLab* days
- *Conf’lunch* and *Unithé ou café* talks: N. Roussel (Rennes in February, Lille in May)

## 9.2. Teaching

### Licence

- Introduction to Programming, 48h, L1, University of Lille, France, F. Aubert
- Advanced Programming, 36h, L3, University of Lille, France, F. Aubert, G. Casiez

### Master

- Introduction to Computer Graphics, 42h, M1, University of Lille, F. Aubert
- Human-Computer Interaction, 48h, M1, University of Lille, G. Casiez, L. Grisoni, P. Plénacoste
- Multi-Touch Interaction, 24h, M1, University of Lille, G. Casiez/F. Aubert
- Advanced Computer Graphics, 20h, M2, University of Lille, L. Grisoni/F. Aubert
- Virtual Reality, 36h, M2, University of Lille, G. Casiez/F. Giraud/F. Aubert
- Artificial Vision, 12h, M2, University of Lille, G. Casiez/L. Grisoni
- Multitouch interaction, 7h, M2, Telecom Lille 1, G. Casiez
- Gesture recognition, 5h, M2, Telecom Lille 1, G. Casiez
- Introduction to virtual reality, 3h, M2, Telecom Lille 1, G. Casiez
- Human-Computer Interaction, 24h, M2, Polytech'Lille, G. Casiez/L. Grisoni
- Human-Computer Interaction, 10h, G2, Ecole Centrale de Lille: N. Roussel

### Ongoing PhD thesis

- J. Aceituno: Lille 1 Univ., advised by N. Roussel, started October 2011
- J. Gilliot: Lille 1 Univ., co-advised by N. Roussel and G. Casiez, started December 2010
- Y. Rekik: Lille 1 Univ., co-advised by L. Grisoni and N. Roussel, started September 2010
- Y. Yi: Beihang University (China), co-advised by B. Lemaire-Semail and Y. Zhang, started September 2010
- E-G. Craciun: Suceava Univ. (Romania), co-advised by L. Grisoni and S-G. Pentiuc, started October 2009
- C. Moerman: Lille 1 Univ., co-advised by C. Chaillou and L. Grisoni, started October 2009
- D. Selosse: Lille 1 Univ., co-advised by L. Grisoni and J. Dequidt, started October 2009
- T. Zheng: Lille 1 Univ., co-advised by B. Lemaire-Semail and F. Giraud, started October 2008
- J-P. Deblonde: Lille 1 Univ., co-advised by L. Grisoni and G. Casiez, started October 2007

## 10. Bibliography

### Major publications by the team in recent years

- [1] M. BIET, F. GIRAUD, B. LEMAIRE-SEMAIL. *Squeeze film effect for the design of an ultrasonic tactile plate*, in "IEEE Transactions on Ultrasonic, Ferroelectric and Frequency Control", December 2007, vol. 54, n<sup>o</sup> 12, p. 2678-2688, <http://dx.doi.org/10.1109/TUFFC.2007.596>.
- [2] G. CASIEZ, N. ROUSSEL. *No more bricolage! Methods and tools to characterize, replicate and compare pointing transfer functions*, in "Proceedings of UIST'11", ACM, October 2011, p. 603-614, <http://dx.doi.org/10.1145/2047196.2047276>.

- [3] G. CASIEZ, N. ROUSSEL, R. VANBELLEGHEM, F. GIRAUD. *Surfpad: riding towards targets on a squeeze film effect*, in "Proceedings of CHI 2011", ACM, May 2011, p. 2491-2500, "Honorable mention" award (top 5%), <http://dx.doi.org/10.1145/1978942.1979307>.
- [4] G. CASIEZ, D. VOGEL, R. BALAKRISHNAN, A. COCKBURN. *The impact of control-display gain on user performance in pointing tasks*, in "Human-Computer Interaction", 2008, vol. 23, n<sup>o</sup> 3, p. 215–250, Taylor and Francis, <http://dx.doi.org/10.1080/07370020802278163>.
- [5] G. CASIEZ, D. VOGEL, Q. PAN, C. CHAILLOU. *RubberEdge: reducing clutching by combining position and rate control with elastic feedback*, in "Proceedings of UIST'07", ACM, 2007, p. 129–138, <http://dx.doi.org/10.1145/1294211.1294234>.
- [6] A. MARTINET, G. CASIEZ, L. GRISONI. *The design and evaluation of 3D positioning techniques for multi-touch displays*, in "Proceedings of 3DUI'10", United States Waltham, IEEE Computer Society, 2010, p. 115–118, <http://dx.doi.org/10.1109/3DUI.2010.5444709>.
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- [8] A. THEETTEN, L. GRISONI, C. ANDRIOT, B. BARSKY. *Geometrically exact dynamic splines*, in "Journal of Computer Aided Design", 2008, vol. 40, n<sup>o</sup> 1, p. 35–48, <http://dx.doi.org/10.1016/j.cad.2007.05.008>.
- [9] RADU DANIEL. VATAVU, D. VOGEL, G. CASIEZ, L. GRISONI. *Estimating the perceived difficulty of pen gestures*, in "Proceedings of INTERACT'11", Springer, September 2011, [http://dx.doi.org/10.1007/978-3-642-23771-3\\_9](http://dx.doi.org/10.1007/978-3-642-23771-3_9).
- [10] D. VOGEL, G. CASIEZ. *Conté: multimodal input inspired by an artist's crayon*, in "Proceedings of UIST'11", ACM, October 2011, <http://dx.doi.org/10.1145/2047196.2047242>.

## Publications of the year

### Doctoral Dissertations and Habilitation Theses

- [11] A. MARTINET. *Etude de l'influence de la séparation des degrés de liberté pour la manipulation 3-D à l'aide de surfaces tactiles multipoints*, Université des Sciences et Technologie de Lille - Lille I, October 2011, <http://hal.inria.fr/tel-00638449/en>.
- [12] J. RINGARD. *Un modèle de conception dédié à l'interaction collaborative colocalisée*, Université des Sciences et Technologie de Lille - Lille I, October 2011, <http://hal.inria.fr/tel-00645026/en>.

### Articles in International Peer-Reviewed Journal

- [13] F. GIRAUD, P. SANDULESCU, M. AMBERG, B. LEMAIRE-SEMAIL, F. IONESCU. *Modeling and Compensation of the Internal Friction Torque of a Travelling Wave Ultrasonic Motor*, in "IEEE Transactions on Haptics", 2011, vol. 4, n<sup>o</sup> 4, p. 327-331, <http://doi.ieeecomputersociety.org/10.1109/TOH.2011.20>.

### Articles in Non Peer-Reviewed Journal

- [14] L. GRISONI, A. BAILLET, J. LOZADA, G. CASIEZ, S. BOUILLAND, F. GIRAUD, D. DRÉAN, D. NADALINI, M. WIERTLEWSKI, J.-M. FLAMANT. *REACTIVE: Development of a tool for rehabilitation for stroke survivors in virtual reality*, in "IRBM", March 2011, vol. 32, n<sup>o</sup> 2 [DOI : 10.1016/J.IRBM.2011.01.025], <http://hal.inria.fr/inria-00638396/en>.

### International Conferences with Proceedings

- [15] M. AMBERG, F. GIRAUD, B. SEMAIL, P. OLIVO, G. CASIEZ, N. ROUSSEL. *STIMTAC, a tactile input device with programmable friction*, in "Adjunct proceedings of UIST'11", ACM, October 2011, p. 7-8, Best demo award, second place, <http://dx.doi.org/10.1145/2046396.2046401>.
- [16] G. CASIEZ, N. ROUSSEL. *No more bricolage! Methods and tools to characterize, replicate and compare pointing transfer functions*, in "Proceedings of UIST'11", ACM, October 2011, p. 603-614, <http://dx.doi.org/10.1145/2047196.2047276>.

- [17] *Best Paper*  
G. CASIEZ, N. ROUSSEL, R. VANBELLEGHEM, F. GIRAUD. *Surfpad: riding towards targets on a squeeze film effect*, in "Proceedings of CHI 2011", ACM, May 2011, p. 2491-2500, "Honorable mention" award (top 5%), <http://dx.doi.org/10.1145/1978942.1979307>.

- [18] RADU DANIEL, VATAVU, D. VOGEL, G. CASIEZ, L. GRISONI. *Estimating the perceived difficulty of pen gestures*, in "Proceedings of INTERACT'11", Springer, September 2011, [http://dx.doi.org/10.1007/978-3-642-23771-3\\_9](http://dx.doi.org/10.1007/978-3-642-23771-3_9).
- [19] D. VOGEL, G. CASIEZ. *Conté: multimodal input inspired by an artist's crayon*, in "Proceedings of UIST'11", ACM, October 2011, <http://dx.doi.org/10.1145/2047196.2047242>.
- [20] Y. YANG, Y. ZHANG, Z. HOU, B. LEMAIRE-SEMAIL. *Adding haptic feedback to touch screens at the right time*, in "Proceedings of ICMI 2011", ACM, 2011, p. 73-80, <http://doi.acm.org/10.1145/2070481.2070497>.
- [21] T. ZENG, F. GIRAUD, B. LEMAIRE-SEMAIL, M. AMBERG. *Haptic Perception of Curvature through Active Touch*, in "Proceedings of World Haptics", IEEE Computer Society, June 2011, p. 533-538, <http://hal.inria.fr/hal-00642528/en>.

### Conferences without Proceedings

- [22] O. LOSSON, G. CASIEZ, F. CABESTAING, F. AUBERT. *Projet Encadré "Image Vision Interaction": Surface Multi-touch*, in "Colloque CETSIS", Québec, Canada, October 2011, <http://hal.inria.fr/inria-00638407/en>.
- [23] P. OLIVO, D. MARCHAL, N. ROUSSEL. *Software requirements for a (more) manageable multi-touch ecosystem*, in "EICS 2011 Workshop on Engineering Patterns for Multi-Touch Interfaces", June 2011, Position paper for the EICS 2011 Workshop on Engineering Patterns for Multi-Touch Interfaces. 4 pages.

### Scientific Books (or Scientific Book chapters)

- [24] F. GIRAUD, B. SEMAIL. *Commande des actionneurs piézoélectriques*, in "Commandes d'actionneurs électriques synchrones et spéciaux", HERMES SCIENCES PUBLICATIONS (editor), EGEM - Génie Electrique, Hermes Sciences Publications, October 2011, <http://hal.inria.fr/hal-00642513/en>.

## Patents and standards

- [25] G. CASIEZ, D. VOGEL. *Multi-touch human interface system and device for graphical input, and method for processing image in such a system*, October 2011, n<sup>o</sup> PCT/FR2011/062409, <http://hal.inria.fr/hal-00643174/en>.
- [26] M. HACHET, J.-B. DE LA RIVIÈRE, B. BOSSAVIT, G. CASIEZ. *Système de colocalisation d'un écran tactile et d'un objet virtuel et dispositif pour la manipulation d'objets virtuels mettant en œuvre un tel système*, June 2011, n<sup>o</sup> 1155341, <http://hal.inria.fr/hal-00643443/en>.

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- [27] M. BEAUDOUIN-LAFON. *Designing interaction, not interfaces*, in "Proceedings of AVI'04", ACM, 2004, p. 15-22, <http://doi.acm.org/10.1145/989863.989865>.
- [28] M. BEAUDOUIN-LAFON, W. E. MACKAY. *Prototyping tools and techniques*, in "The Human Computer Interaction handbook: fundamentals, evolving technologies and emerging applications", A. SEARS, J. A. JACKO (editors), CRC Press, 2007, p. 1017-1039.
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