IN PARTNERSHIP WITH:
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Université Paris-Sud (Paris 11)

Activity Report 2019

Project-Team EX-SITU

Extreme Interaction

IN COLLABORATION WITH: Laboratoire de recherche en informatique (LRI)

RESEARCH CENTER
Saclay - Île-de-France

THEME
Interaction and visualization

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Project-Team EX-SITU

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A5.1.5. - Body-based interfaces
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1. Team, Visitors, External Collaborators

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2. Overall Objectives

2.1. Overall Objectives

Interactive devices are everywhere: we wear them on our wrists and belts; we consult them from purses and pockets; we read them on the sofa and on the metro; we rely on them to control cars and appliances; and soon we will interact with them on living room walls and billboards in the city. Over the past 30 years, we have witnessed tremendous advances in both hardware and networking technology, which have revolutionized all aspects of our lives, not only business and industry, but also health, education and entertainment. Yet the ways in which we interact with these technologies remains mired in the 1980s. The graphical user interface (GUI), revolutionary at the time, has been pushed far past its limits. Originally designed to help secretaries perform administrative tasks in a work setting, the GUI is now applied to every kind of device, for every kind of setting. While this may make sense for novice users, it forces expert users to use frustratingly inefficient and idiosyncratic tools that are neither powerful nor incrementally learnable.

ExSitu explores the limits of interaction — how extreme users interact with technology in extreme situations. Rather than beginning with novice users and adding complexity, we begin with expert users who already face extreme interaction requirements. We are particularly interested in creative professionals, artists and designers who rewrite the rules as they create new works, and scientists who seek to understand complex phenomena through creative exploration of large quantities of data. Studying these advanced users today will not only help us to anticipate the routine tasks of tomorrow, but to advance our understanding of interaction itself. We seek to create effective human-computer partnerships, in which expert users control their interaction with technology. Our goal is to advance our understanding of interaction as a phenomenon, with a corresponding paradigm shift in how we design, implement and use interactive systems. We have already made significant progress through our work on instrumental interaction and co-adaptive systems, and we hope to extend these into a foundation for the design of all interactive technology.

3. Research Program

3.1. Research Program

We characterize Extreme Situated Interaction as follows:

Extreme users. We study extreme users who make extreme demands on current technology. We know that human beings take advantage of the laws of physics to find creative new uses for physical objects. However, this level of adaptability is severely limited when manipulating digital objects. Even so, we find that creative professionals—artists, designers and scientists—often adapt interactive technology in novel and unexpected ways and find creative solutions. By studying these users, we hope to not only address the specific problems they face, but also to identify the underlying principles that will help us to reinvent virtual tools. We seek to shift the paradigm of interactive software, to establish the laws of interaction that significantly empower users and allow them to control their digital environment.

Extreme situations. We develop extreme environments that push the limits of today's technology. We take as given that future developments will solve "practical" problems such as cost, reliability and performance and concentrate our efforts on interaction in and with such environments. This has been a successful strategy in the past: Personal computers only became prevalent after the invention of the desktop graphical user interface. Smartphones and tablets only became commercially successful after Apple cracked the problem of a usable touch-based interface for the iPhone and the iPad. Although wearable technologies, such as watches and glasses, are finally beginning to take off, we do not believe that they will create the major disruptions already caused by personal computers, smartphones and tablets. Instead, we believe that future disruptive technologies will include fully interactive paper and large interactive displays.

Our extensive experience with the Digiscope WILD and WILDER platforms places us in a unique position to understand the principles of distributed interaction that extreme environments call for. We expect to integrate, at a fundamental level, the collaborative capabilities that such environments afford. Indeed almost all of our activities in both the digital and the physical world take place within a complex web of human relationships. Current systems only support, at best, passive sharing of information, e.g., through the distribution of independent copies. Our goal is to support active collaboration, in which multiple users are actively engaged in the lifecycle of digital artifacts.

Extreme design. We explore novel approaches to the design of interactive systems, with particular emphasis on extreme users in extreme environments. Our goal is to empower creative professionals, allowing them to act as both designers and developers throughout the design process. Extreme design affects every stage, from requirements definition, to early prototyping and design exploration, to implementation, to adaptation and appropriation by end users. We hope to push the limits of participatory design to actively support creativity at all stages of the design lifecycle. Extreme design does not stop with purely digital artifacts. The advent of digital fabrication tools and FabLabs has significantly lowered the cost of making physical objects interactive. Creative professionals now create hybrid interactive objects that can be tuned to the user's needs. Integrating the design of physical objects into the software design process raises new challenges, with new methods and skills to support this form of extreme prototyping.

Our overall approach is to identify a small number of specific projects, organized around four themes: *Creativity, Augmentation, Collaboration* and *Infrastructure*. Specific projects may address multiple themes, and different members of the group work together to advance these different topics.

4. Application Domains

4.1. Creative industries

We work closely with creative professionals in the arts and in design, including music composers, musicians, and sound engineers; painters and illustrators; dancers and choreographers; theater groups; game designers; graphic and industrial designers; and architects.

4.2. Scientific research

We work with creative professionals in the sciences and engineering, including neuroscientists and doctors; programmers and statisticians; chemists and astrophysicists; and researchers in fluid mechanics.

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- Wanyu Liu: First prize, Télécom ParisTech thesis award, "Information theory as a unified tool for understanding and designing human-computer interaction"
- Stacy Hsueh, Sarah Fdili Alaoui, and Wendy Mackay: Honorable Mention Award at ACM CSCW 2019 for "Deconstructing Creativity: Non-Linear Processes and Fluid Roles in Contemporary Music and Dance." [21]
- Alexander Eiselmayer, Chat Wacharamanotham, Michel Beaudouin-Lafon, and Wendy Mackay: Best Paper award at ACM CHI 2019 for "Touchstone2: An Interactive Environment for Exploring Trade-offs in HCI Experiment Design" [19]

6. New Software and Platforms

6.1. Digiscape

KEYWORDS: 2D - 3D - Node.js - Unity 3D - Video stream

FUNCTIONAL DESCRIPTION: Through the Digiscape application, the users can connect to a remote workspace and share files, video and audio streams with other users. Application running on complex visualization platforms can be easily launched and synchronized.

- Partners: Maison de la simulation - UVSQ - CEA - ENS Cachan - LIMSI - LRI - Laboratoire de Recherche en Informatique - CentraleSupélec - Telecom Paris
- Contact: Olivier Gladin
- URL: http://www.digiscope.fr

6.2. Touchstone2

KEYWORD: Experimental design

FUNCTIONAL DESCRIPTION: Touchstone2 is a graphical user interface to create and compare experimental designs. It is based on a visual language: Each experiment consists of nested bricks that represent the overall design, blocking levels, independent variables, and their levels. Parameters such as variable names, counterbalancing strategy and trial duration are specified in the bricks and used to compute the minimum number of participants for a balanced design, account for learning effects, and estimate session length. An experiment summary appears below each brick assembly, documenting the design. Manipulating bricks immediately generates a corresponding trial table that shows the distribution of experiment conditions across participants. Trial tables are faceted by participant. Using brushing and fish-eye views, users can easily compare among participants and among designs on one screen, and examine their trade-offs.

Touchstone2 plots a power chart for each experiment in the workspace. Each power curve is a function of the number of participants, and thus increases monotonically. Dots on the curves denote numbers of participants for a balanced design. The pink area corresponds to a power less than the 0.8 criterion: the first dot above it indicates the minimum number of participants. To refine this estimate, users can choose among Cohen's three conventional effect sizes, directly enter a numerical effect size, or use a calculator to enter mean values for each treatment of the dependent variable (often from a pilot study).

Touchstone2 can export a design in a variety of formats, including JSON and XML for the trial table, and TSL, a language we have created to describe experimental designs. A command-line tool is provided to generate a trial table from a TSL description.

Touchstone2 runs in any modern Web browser and is also available as a standalone tool. It is used at ExSitu for the design of our experiments, and by other Universities and research centers worldwide. It is available under an Open Source licence at https://touchstone2.org.

- Partner: University of Zurich
- Contact: Wendy Mackay
- URL: https://touchstone2.org

6.3. UnityCluster

KEYWORDS: 3D - Virtual reality - 3D interaction

FUNCTIONAL DESCRIPTION: UnityCluster is middleware to distribute any Unity 3D (https://unity3d.com/) application on a cluster of computers that run in interactive rooms, such as our WILD and WILDER rooms, or immersive CAVES (Computer-Augmented Virtual Environments). Users can interact the the application with various interaction resources.

UnityCluster provides an easy solution for running existing Unity 3D applications on any display that requires a rendering cluster with several computers. UnityCluster is based on a master-slave architecture: The master computer runs the main application and the physical simulation as well as manages the input, the slave computers receive updates from the master and render small parts of the 3D scene. UnityCluster manages data distribution and synchronization among the computers to obtain a consistent image on the entire wall-sized display surface.

UnityCluster can also deform the displayed images according to the user's position in order to match the viewing frustum defined by the user's head and the four corners of the screens. This respects the motion parallax of the 3D scene, giving users a better sense of depth.

UnityCluster is composed of a set of C Sharp scripts that manage the network connection, data distribution, and the deformation of the viewing frustum. In order to distribute an existing application on the rendering cluster, all scripts must be embedded into a Unity package that is included in an existing Unity project.

- Partner: Inria
- Contact: Cédric Fleury

6.4. VideoClipper

KEYWORD: Video recording

FUNCTIONAL DESCRIPTION: VideoClipper is an IOS app for Apple Ipad, designed to guide the capture of video during a variety of prototyping activities, including video brainstorming, interviews, video prototyping and participatory design workshops. It relies heavily on Apple's AVFoundation, a framework that provides essential services for working with time-based audiovisual media on iOS (https://developer.apple.com/av-foundation/). Key uses include: transforming still images (title cards) into video tracks, composing video and audio tracks in memory to create a preview of the resulting video project and saving video files into the default Photo Album outside the application.

VideoClipper consists of four main screens: project list, project, capture and import. The project list screen shows a list with the most recent projects at the top and allows the user to quickly add, remove or clone (copy and paste) projects. The project screen includes a storyboard composed of storylines that can be added, cloned or deleted. Each storyline is composed of a single title card, followed by one or more video clips. Users can reorder storylines within the storyboard, and the elements within each storyline through direct manipulation. Users can preview the complete storyboard, including all titlecards and videos, by pressing the play button, or export it to the Ipad's Photo Album by pressing the action button.

VideoClipper offers multiple tools for editing titlecards and storylines. Tapping on the title card lets the user edit the foreground text, including font, size and color, change background color, add or edit text labels, including size, position, color, and add or edit images, both new pictures and existing ones. Users can also delete text labels and images with the trash button. Video clips are presented via a standard video player, with standard interaction. Users can tap on any clip in a storyline to: trim the clip with a non-destructive trimming tool, delete it with a trash button, open a capture screen by clicking on the camera icon, label the clip by clicking a colored label button, and display or hide the selected clip by toggling the eye icon.

VideoClipper is currently in beta test, and is used by students in two HCI classes at the Université Paris-Saclay, researchers in ExSitu as well as external researchers who use it for both teaching and research work. A beta test version is available on demand under the Apple testflight online service.

- Contact: Wendy Mackay

6.5. WildOS

KEYWORDS: Human Computer Interaction - Wall displays

FUNCTIONAL DESCRIPTION: WildOS is middleware to support applications running in an interactive room featuring various interaction resources, such as our WILD and WILDER rooms: a tiled wall display, a motion tracking system, tablets and smartphones, etc. The conceptual model of WildOS is a platform, such as the WILD or WILDER room, described as a set of devices and on which one or more applications can be run.

WildOS consists of a server running on a machine that has network access to all the machines involved in the platform, and a set of clients running on the various interaction resources, such as a display cluster or a tablet. Once WildOS is running, applications can be started and stopped and devices can be added to or removed from the platform.

WildOS relies on Web technologies, most notably Javascript and node.js, as well as node-webkit and HTML5. This makes it inherently portable (it is currently tested on Mac OS X and Linux). While applications can be developed only with these Web technologies, it is also possible to bridge to existing applications developed in other environments if they provide sufficient access for remote control. Sample applications include a web browser, an image viewer, a window manager, and the BrainTwister application developed in collaboration with neuroanatomists at NeuroSpin.

WildOS is used for several research projects at ExSitu and by other partners of the Digiscope project. It was also deployed on several of Google's interactive rooms in Mountain View, Dublin and Paris. It is available under an Open Source licence at https://bitbucket.org/mblinsitu/wildos.

- Contact: Michel Beaudouin-Lafon
- URL: https://bitbucket.org/mblinsitu/wildos

6.6. Platforms

6.6.1. WILDER

Participants: Michel Beaudouin-Lafon [correspondant], Cédric Fleury, Olivier Gladin.

WILDER (Figure 1) is our second experimental ultra-high-resolution interactive environment, which follows the WILD platform developed in 2009. It features a wall-sized display with seventy-five 20" LCD screens, i.e. a 5m50 x 1m80 (18' x 6') wall displaying 14 400 x 4 800 = 69 million pixels, powered by a 10-computer cluster and two front-end computers. The platform also features a camera-based motion tracking system that lets users interact with the wall, as well as the surrounding space, with various mobile devices. The display uses a multitouch frame (the largest of its kind in the world) to make the entire wall touch sensitive.

WILDER was inaugurated in June, 2015. It is one of the ten platforms of the Digiscope Equipment of Excellence and, in combination with WILD and the other Digiscope rooms, provides a unique experimental environment for collaborative interaction.

In addition to using WILD and WILDER for our research, we have also developed software architectures and toolkits, such as WildOS and Unity Cluster, that enable developers to run applications on these multi-device, cluster-based systems.

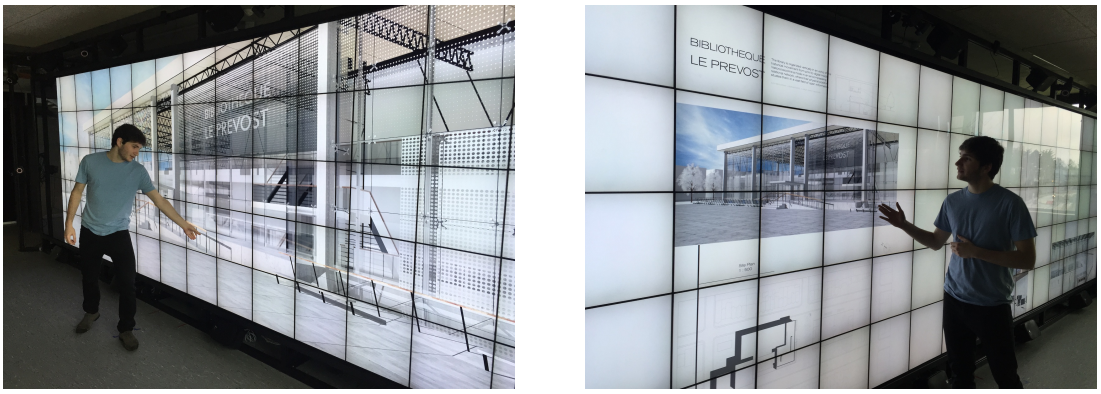

Figure 1. The WILDER platform.

7. New Results

7.1. Fundamentals of Interaction

Participants: Michel Beaudouin-Lafon [correspondant], Wendy Mackay, Cédric Fleury, Theophanis Tsandilas, Benjamin Bressolette, Julien Gori, Han Han, Yiran Zhang, Miguel Renom, Philip Tchernavskij, Martin Tricaud.

In order to better understand fundamental aspects of interaction, ExSitu conducts in-depth observational studies and controlled experiments which contribute to theories and frameworks that unify our findings and help us generate new, advanced interaction techniques. Our theoretical work also leads us to deepen or re-analyze existing theories and methodologies in order to gain new insights.

At the methodological level and in collaboration with University of Zurich (Switzerland), we have developed *Touchstone2* [19] (Best Paper award), a direct-manipulation interface for generating and examining trade-offs in experiment designs (Fig. 2). Based on interviews with experienced researchers, we developed an interactive environment for manipulating experiment design parameters, revealing patterns in trial tables, and estimating and comparing statistical power. We also developed TSL, a declarative language that precisely represents experiment designs. In two studies, experienced HCI researchers successfully used *Touchstone2* to evaluate design trade-offs and calculate how many participants are required for particular effect sizes. *Touchstone2* is freely available at https://touchstone2.org and we encourage the community to use it to improve the accountability and reproducibility of research by sharing TSL descriptions of their experimental designs.

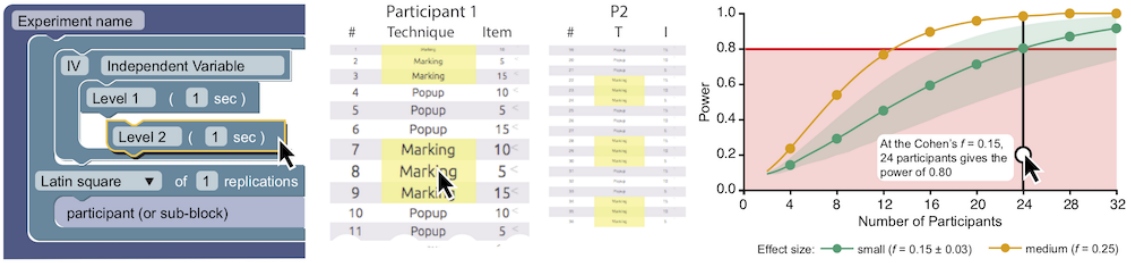

Figure 2. Touchstone2: visual language to specify an experimental design, trial table with fish-eye view, power plot.

The book "Sticky Creativity: Post-It Note Cognition, Interaction and Digitalization" [32], Academic Press, explores how the Post-It note has "become the most commonly used design material in creative design activities", with research and use cases to illustrate its role creative activities. Wendy Mackay converted her one-day Master Class on participatory design methods into a book chapter, shifting the designer's focus from static wireframes to prototyping how users will interact with a proposed new technology. The course takes the reader through a full interaction design cycle, with nine illustrated participatory design methods. It begins with a design brief: create an augmented sticky note inspired by observations of how people actually use paper sticky notes. Story-based interviews reveal both breakdowns and creative new uses of sticky notes. Brainstorming and video brainstorming, informed by the users' stories, generate new ideas. Paper prototyping a design concept related to augmented sticky notes lets designers explore ideas for a future system to address an untapped need or desire. Shooting a video prototype, guided by titlecards and a storyboard, illustrates how future users will interact with the proposed system. Finally, a design walkthrough identifies key problems and suggests ideas for improvement.

At the theoretical level, we have continued our exploration of Information Theory as a design tool for HCI by analyzing past and current applications of Shannon's theory to HCI research to identify areas where information-theoretic concepts can be used to understand, design and optimize human-computer communication [30]. We have also continued our long-standing strand of work on pointing by evaluating several models for assessing pointing performance by participants with motor impairments [27]. Namely, we studied the strengths of weaknesses of various models, from traditional Fitts' Law to the WHo model, the EMG regression and the method of Positional Variance Profiles (PVPs), on datasets from abled participants vs. participants with dyspraxia.

In the context of the ERC ONE project on Unified Principles of Interaction, Philip Tchernavskij defended his Ph.D. thesis on malleable software [40]. The goal of malleable software is to make is as easy as possible for users themselves to change software, or to have it changed on their behalf in response to their developing needs. Current approaches do not address this issue adequately: software engineering promotes flexible code, but in practice this does not help end-users effect change in their software. Based on a study of a network of communities working with biodiversity data, we found that the mode of software production, i.e. the

technologies and economic relations that produce software, is biased towards centralized, one-size-fits-all systems. Instead, we should seek to create infrastructures for plurality, i.e. tools that help multiple communities collaborate without forcing them to consolidate around identical interfaces or data representations. Malleable software seeks to maximize the kinds of modifications that can take place through regular interactions, e.g. direct manipulation of interface elements. By generalizing existing control structures for interaction under the concepts of co-occurrences and entanglements, we created an environment where interactions can be dynamically created and modified. The *Tangler* prototype illustrates the power of these concepts to create malleable software.

In collaboration with Aarhus University (Denmark), we created *Videostrates* [22] to explore the notion of an *interactive substrate* for video data. *Videostrates* is based on our joint previous work on *Webstrates* (https://webstrates.net) and supports both live and recorded video composition with a declarative HTML-based notation, combining both simple and sophisticated editing tools that can be used collaboratively. *Videostrates* is programmable and unleashes the power of the modern web platform for video manipulation. We demonstrated its potential through three use scenarios (Fig. 3): collaborative video editing with multiple tools and devices; orchestration of multiple live streams that are recorded and broadcast to a popular streaming platform; and programmatic creation of video using WebGL and shaders for blue screen effects. These scenarios demonstrate *Videostrates*' potential for novel collaborative video editors with fully programmable interfaces.

Figure 3. Videostrates examples: A) Two users collaboratively edit the same videostrate, one with a timeline-based editor and the other with a subtitle editor. The results appear in a live, interactive preview on a large screen. B) Videostrates aggregates, broadcasts and records multiple live streams, here from a statically mounted camera and a smartphone. C) A Videostrate-based computational notebook uses Codestrates to programmatically create a WebGL animation and synchronize its playback with recorded video composited with a green screen.

We conducted an in-depth observational study of landscape architecture students to reveal a new phenomenon in pen-and-touch surface interaction: *interstices* [24]. We observed that bimanual interactions with a pen and touch surface involved various sustained hand gestures, interleaved between their regular commands. Positioning of the non-preferred hand indicates anticipated actions, including: sustained hovering near the surface; pulled back but still floating above the surface; resting in their laps; and stabilizing the preferred hand while handwriting. These intersticial actions reveal anticipated actions and therefore should be taken into account in the design of novel interfaces.

We also started a study of blind or visually impaired people to better understand how they use graphical user interfaces [28]. The goal is to design multimodal interfaces for sighted users that do not rely on the visual channel as much as current GUIs.

In collaboration with the University of Paris Descartes and the ILDA Inria team, we investigated how to help users to query massive data series collections within interaction times. We demonstrated the importance of providing progressive whole-matching similarity search results on large time series collections (100 GB). Our experiments showed that there is a significant gap between the time the 1st Nearest Neighbor (1-NN) is found and the time when the search algorithm terminates [29]. In other words, users often wait without any improvement in their answers. We further showed that high-quality approximate answers are found very early,

e.g., in less than one second, so they can support highly interactive visual analysis tasks. We discussed how to estimate probabilistic distance bounds, and how to help analysts evaluate the quality of their progressive results. The results of this collaboration have lead to Gogolou's Ph.D. thesis (ILDA Inria team) [38].

In the context of virtual reality, we explored how to integrate the real world surrounding users in the virtual environment. In many virtual reality systems, user physical workspace is superposed with a particular area of the virtual environment. This spatial consistency allows users to physically walk in the virtual environment and interact with virtual content through tangible objects. However, as soon as users perform virtual navigation to travel on a large scale (i.e. move their physical workspace in the virtual environment), they break this spatial consistency. We introduce two switch techniques to help users to recover the spatial consistency in some predefined virtual areas when using a teleportation technique for the virtual navigation [26]. We conducted a controlled experiment on a box-opening task in a CAVE-like system to evaluate the performance and usability of these switch techniques. The results highlight that helping the user to recover a spatially consistency ensures the accessibility of the entire virtual interaction space of the task. Consequently, the switch techniques decrease time and cognitive effort required to complete the task.

7.2. Human-Computer Partnerships

Participants: Wendy Mackay [correspondant], Baptiste Caramiaux, Téo Sanchez, Carla Griggio, Shu Yuan Hsueh, Wanyu Liu, Joanna Mcgrenere, Midas Nouwens.

ExSitu is interested in designing effective human-computer partnerships, in which expert users control their interaction with technology. Rather than treating the human users as the 'input' to a computer algorithm, we explore human-centered machine learning, where the goal is to use machine learning and other techniques to increase human capabilities. Much of human-computer interaction research focuses on measuring and improving productivity: our specific goal is to create what we call 'co-adaptive systems' that are discoverable, appropriable and expressive for the user.

In creative practices, human-centred machine learning facilitates the workflow for creatives to explore new ideas and possibilities. We compiled recent research and development advances in human-centred machine learning and artificial intelligence (AI), within the field of creative industries, in a white paper commissioned by the NEM (New European Media) initiative [35]. We explored the use of Deep Reinforcement Learning in the context of sound design with sound design experts [37]. We first conducted controlled studies where we compared manual exploration versus exploration by reinforcement. This helped us design a fully working system that we assessed in workshops with expert designers. We showed that an algorithmic sound explorer learning from human preferences enhances the creative process by allowing holistic and embodied exploration as opposed to analytic exploration afforded by standard interfaces.

We also explored how users create their own ecosystems of communication apps as a way to support rich, personalized forms of expression [12]. We wanted to gather data about how people customize apps to enable more personal forms of expression, and how such customizations shape their everyday communication. Given the increasing use of multiple apps with overlapping communication features, we were also interested in how customizing one app influences communication via other apps. We created a taxonomy of customization options based on interviews with 15 "extreme users" of communication apps. We found that participants tailored their apps to express their identities, organizational culture, and intimate bonds with others. They also experienced expression breakdowns: frustrations around barriers to transferring personal forms of expression across apps, which inspired inventive workarounds to maintain cross-app habits of expression, such as briefly switching apps to generate and export content for a particular conversation. We conclude with implications for personalized expression in ecosystems of communication apps.

We investigated the special communication practices between couples [20]. Research shows that sharing streams of contextual information, e.g. location and motion, helps couples coordinate and feel more connected. We studied how couples' communication changes when sharing multiple, persistent information streams. We designed *Lifelines*, a mobile-app technology probe that visualizes up to six streams on a shared timeline: closeness to home, battery level, steps, media playing, texts and calls. A month-long study with nine couples

showed that partners interpreted information mostly from individual streams, but also combined them for more nuanced interpretations. Persistent streams allowed missing data to become meaningful and provided new ways of understanding each other. Unexpected patterns from any stream can trigger calls and texts, whereas seeing expected data can replace direct communication, which may improve or disrupt established communication practices.

Finally, we extended our earlier work on the *Expressive Keyboard* by adding animated emojis as a form of expressive output for messaging apps. An initial user study identified both the cumbersome nature of inserting emojis and the creative ways that users construct emoji sequences to convey rich, nuanced non-verbal expressions, including emphasis, change of expressions, and micro stories. We then developed *MojiBoard* [17], an emoji entry technique that lets users generate dynamic parametric emojis from a gesture keyboard. Here, the form of the user's gesture is transformed into an animation, allowing users to "draw" dynamic expressions through their own movements. *MojiBoard* lets users switch seamlessly between typing and parameterizing emojis. *MojiBoard* provides an example of how we can transform a user's gesture into an expressive output, which is reified into an emoji than can be interacted with again.

Wendy Mackay describes how the theoretical foundation of the CREATIV ERC Advance Grant, based on the principle of co-adaptation, influenced her research with musicians, choreographers, graphic designers and other creative professionals. The interview is published in the book "New Directions in Music and Human-Computer Interaction", Springer Nature, as a chapter entitled "HCI, Music and Art: An Interview with Wendy Mackay" [34]. Along the same lines, she contributed to a chapter "A Design Workbench for Interactive Music Systems" [33] that discusses possible links between the fields of computer music and human-computer interaction (HCI), particularly in the context of the MIDWAY project between Inria, France and McGill University, Canada. The goal of MIDWAY was to construct a "musical interaction design workbench" to facilitate the exploration and development of new interactive technologies for musical creation and performance by bringing together useful models, tools, and recent developments from computer music and HCI. These models and tools have helped expand the possibilities for enhancing musical expression, and provide HCI researchers with a better foundation for the design of tools for "extreme" users.

7.3. Creativity

Participants: Sarah Fdili Alaoui [correspondant], Carla Griggio, Shu Yuan Hsueh, Wendy Mackay, Baptiste Caramiaux, Joanna Mcgrenere, Midas Nouwens, Jean-Philippe Riviere, Nicolas Taffin, Philip Tchernavskij, Theophanis Tsandilas.

ExSitu is interested in understanding the work practices of creative professionals, particularly artists, designers, and scientists, who push the limits of interactive technology. We follow a multi-disciplinary participatory design approach, working with both expert and non-expert users in diverse creative contexts. We also create situations that cause users to reflect deeply on their activities in situ and collaborate to articulate new design problems.

We conducted an interview study of 23 contemporary music composers and choreographers where we focused on the role that physical artifacts play in shaping creative collaborations with performers [13]. We found that creators and performers form relationships where the creator acts as a author, a curator, a planner, or a researcher and the performer acts as an interpreter, a creator, an improvisor, or an informant. Furthermore, we found that creators sculpt, layer and remix artifacts, moving fluidly across these different forms of interaction throughout the creative process.

We studied Kinaesthetic creativity which refers to the body's ability to generate alternate futures [21]. We probe such creative process by studying how dancers interact with technology to generate ideas. We developed a series of parameterized interactive visuals and asked dance practitioners to use them in generating movement materials. From our study, we define a taxonomy that comprises different relationships and movement responses dancers form with the visuals. We describe resulting types of interaction patterns and demonstrate how dance creativity is driven by the ability to shift between these patterns.

We used technology probes to understand how dancers learned dance fragments from videos [15]. We introduced *MoveOn*, which lets dancers decompose video into short, repeatable clips to support their learning. This served as an effective analysis tool for identifying the changes in focus and understanding dancers decomposition and recomposition processes. Additionally we compared the teacher's and dancers' decomposition strategies, and how dancers learn on their own compared to teacher-created decompositions. We found that they all ungroup and regroup dance fragments, but with different foci of attention, which suggests that teacher-imposed decomposition is more effective for introductory dance students, whereas personal decomposition is more suitable for expert dancers.

We ran a workshop [25] at ACM *Creativity and Cognition* that explored how distributed forms of creativity arising in play can help guide and foster supportive research, game design, and technology. We brought together researchers, game designers, and others to examine theories of creativity and play, game design practices, and methods for studying creativity.

We developed a taxonomy [18] on technologies using Defamiliarization to to support Co-Creation in choreographic practices. Regarding intersection of choreographic practice and HCI, Sarah Fdili Alaoui [16] describe her research and creation journey of an interactive choreographic dance piece called SKIN. This generated a set of research questions that she addresses through experience explicitation interviews of both audience and creative team members on the lived experience of making and attending the performance and the emergent relationships between dance, media and interaction as well as the tensions and negotiations that emerged from integrating technology in art. She discusses her approach as anti-solutionist and argue for more openness in HCI to allow artists to contribute.

Finally, we assessed the inter-rater reliability of the Laban Movement Analysis system used in choreography and dance notation [11].

7.4. Collaboration

Participants: Cédric Fleury [correspondant], Michel Beaudouin-Lafon, Wendy Mackay, Carla Griggio, Yujiro Okuya, Arthur Fages.

ExSitu explores new ways of supporting collaborative interaction and remote communication. In particular, we studied co-located collaboration on large wall-sized display, video-conferencing systems for remote collaboration, and collaboration between professional designers and developers during the design of interactive systems.

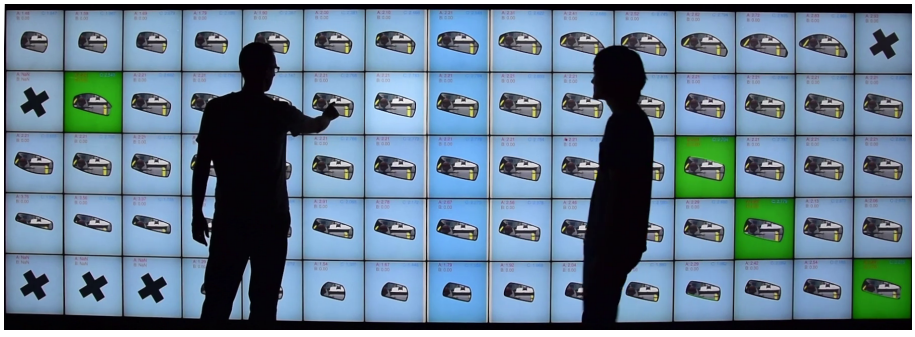

Figure 4. Collaborative exploration of multiple design alternatives of a car rear-view mirror on a wall-sized display.

Multi-touch wall-sized displays, as those of the Digiscope network (http://digiscope.fr/, afford collaborative exploration of large datasets and re-organization of digital content. In the context of industrial design, computer-aided design (CAD) is now an essential part of the design process allowing experts to evaluate and adjust product design using digital mock-ups. We investigated how a wall-sized display could be used to allow multidisciplinary collaborators (e.g. designers, engineers, ergonomists) to explore large number of design alternatives. In particular, we design a system which allows non-CAD expert to generate and distribute on a wall-sized display multiple various of a CAD model (Figure 4). We ran a usability study and a controlled experiment to assess the benefit of wall-sized displays in such context. Yujiro Okuya, under the supervision of Patrick Bourdot (LIMSI-CNRS) and Cédric Fleury, successfully defended his thesis *CAD Modification Techniques for Design Reviews on Heterogeneous Interactive Systems* [39] on this topic.

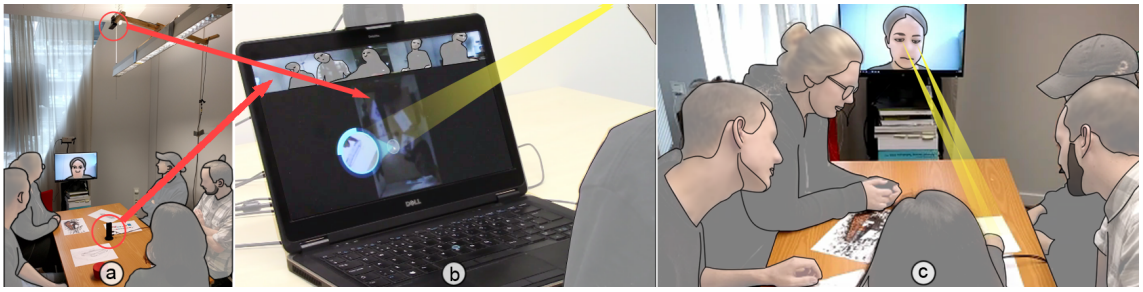

Figure 5. GazeLens system. (left) On the coworkers' side, a 360 camera on the table captures coworkers and a webcam mounted on the ceiling captures artifacts on the table. (middle) Video feeds from the two cameras are displayed on the screen of the remote satellite worker; a virtual lens strategically guides her/his attention towards a specific screen area according to the observed artifact. (right) The satellite's gaze, guided by the virtual lens, is aligned towards the observed artifact on the coworkers' space.

For remote collaboration using video, interpreting gaze direction is critical for communication between coworkers sitting around a table and a remote satellite colleague. However, 2D video distorts images and makes this interpretation inaccurate. We proposed GazeLens [23], a video conferencing system that improves coworkers' ability to interpret the satellite worker's gaze (Figure 5). A 360 camera captures the coworkers and a ceiling camera captures artifacts on the table. The system combines these two video feeds in an interface. Lens widgets strategically guide the satellite worker's attention toward specific areas of her/his screen allowing coworkers to clearly interpret her/his gaze direction. Controlled experiments showed that GazeLens increases coworkers' overall gaze interpretation accuracy in comparison to a conventional video conferencing system.

Finally, we also conducted an in-depth study of the collaboration patterns between designers and developers of interactive systems, and created a tool, *Enact*, to facilitate their work [14]. Professional designers and developers often struggle when transitioning between the design and implementation of an interactive system. We found that current practices induce unnecessary rework and cause discrepancies between design and implementation. We identified three recurring types of breakdowns: omitting critical details, ignoring edge cases, and disregarding technical limitations. We introduced four design principles to create tools that mitigate these problems: Provide multiple viewpoints, maintain a single source of truth, reveal the invisible and support design by enaction. We applied these principles to create *Enact*, a live environment for prototyping touch-based interactions (Fig. 6). We conducted two studies to assess *Enact* and compare it with current tools. Results suggest that *Enact* helps participants detect more edge cases, increases designers' participation and provides new opportunities for co-creation.

8. Partnerships and Cooperations

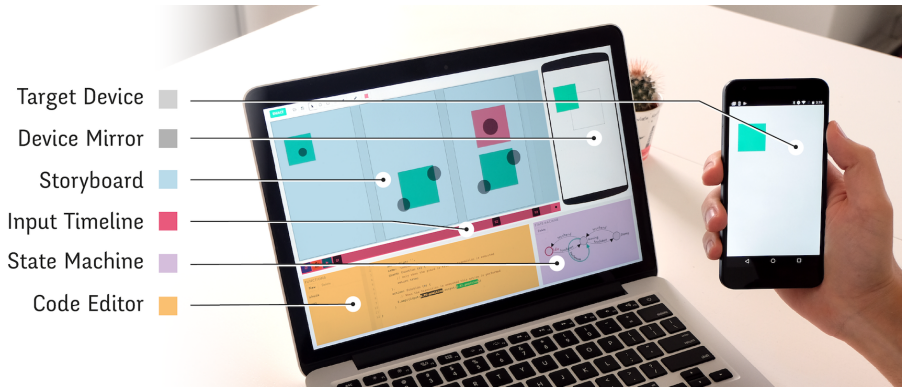

Figure 6. Enact uses a target mobile device and a desktop interface with five areas: a storyboard with consecutive screens, an event timeline with a handle for each screen, a state machine, a code editor and a device mirror.

8.1. Regional Initiatives

8.1.1. Virtual Reality for Interacting with Building Information Model at Paris-Saclay

Type: Equipment and human resources

Funding: STIC Paris-Saclay

Duration: 2018-2019

Coordinator: Jean-Marc Vézien (LIMSI-CNRS)

Partners: CNRS, Univ. Paris-Sud

Inria contact: Cédric Fleury

Abstract: The goal of this project is to develop interactive tools for BIM application in virtual reality using a user-centered design approach. The project will use as a case study the interior design of the *Learning Center* building on Paris-Saclay campus.

8.1.2. Projet numérique du Learning Center de l'Université

Type: Equipment and subcontracting

Funding: Learning Center Paris-Saclay

Duration: 2019

Coordinator: Michel Beaudouin-Lafon

Partners: Univ. Paris-Sud

Inria contact: Michel Beaudouin-Lafon

Abstract: The goal of this project (30k) is to create an interactive installation presenting the portraits of Ph.D. students from Université Paris-Saclay. It is a collaboration with portrait photographer Didier Goupy. The installation is designed to be exhibited in various sites of Université Paris-Saclay until it is permanently installed in the Learning Center of Université Paris-Saclay. The project was presented at the Ph.D. graduation ceremony of Université Paris-Saclay in June, 2019, and at the Fête de la Science in October, 2019, and will be permanently exhibited in the future Learning Center of Université Paris-Saclay.

8.1.3. Living Archive

Type: Equipment and human resources

Funding: STIC department grant

Duration: 2019-2020

Coordinator: Sarah Fdili Alaoui

Partners: Learning Center

Inria contact: Sarah Fdili Alaoui

Abstract: The project's ambition is to design interactive systems that allow practioners to easily document their dance using their own methods and personal artifacts emphasizing a first-person perspective and minimizing imposed choices from academic researchers.

8.2. National Initiatives

8.2.1. ANR

ELEMENT: Enabling Learnability in Human Movement Interaction

Type: Equipment and human resources

Funding: ANR

Duration: 2019-2022

Coordinator: Baptiste Caramiaux, Sarah Fdili Alaoui, Wendy Mackay

Partners: IRCAM, LIMSI

Inria contact: Baptiste Caramiaux

Abstract: The goal of this project is to foster innovation in multimodal interaction, from non-verbal communication to interaction with digital media/content in creative applications, specifically by addressing two critical issues: the design of learnable gestures and movements; and the development of interaction models that adapt to a variety of user's expertise and facilitate human sensorimotor learning.

8.2.2. Investissements d'Avenir

8.2.2.1. Digiscope - Collaborative Interaction with Complex Data and Computation

Type: EQUIPEX (Equipement d'Excellence)

Duration: 2011-2019

Coordinator: Michel Beaudouin-Lafon

Partners: Université Paris-Saclay (coordinator), Université Paris-Sud, CNRS, CEA, Inria, Institut Mines-Telecom, CentraleSupelec, Université Versailles - Saint-Quentin, ENS Paris-Saclay, Maison de la Simulation

Overall budget: 22.5 Meuros, including 6.7 Meuros public funding from ANR

Abstract: The goal of the project is to create ten high-end interactive rooms interconnected by high-speed networks and audio-video facilities to support remote collaboration across interactive visualization environments. The equipment will be open to outside users and targets four main application areas: scientific discovery, product lifetime management, decision support for crisis management, and education and training. Digiscope includes the existing WILD room, and funded the WILDER room. ExSitu contributes its expertise in the design and evaluation of advanced interaction techniques and the development of distributed software architectures for interactive systems. All ten rooms and the telepresence network are operational. The project was successfully evaluated by an international jury in June, 2017.

8.3. European Initiatives

8.3.1. European Research Council (ERC)

8.3.1.1. Creating Human-Computer Partnerships

Program: ERC Advanced Grant

Project acronym: CREATIV

Project title: Creating Human-Computer Partnerships

Duration: June 2013 - May 2019

Coordinator: Wendy Mackay

Abstract: CREATIV explores how the concept of co-adaptation can revolutionize the design and use of interactive software. Co-adaptation is the parallel phenomenon in which users both adapt their behavior to the system's constraints, learning its power and idiosyncrasies, and appropriate the system for their own needs, often using it in ways unintended by the system designer. A key insight in designing for co-adaptation is that we can encapsulate interactions and treat them as first class objects, called interaction instruments This lets us focus on the specific characteristics of how human users express their intentions, both learning from and controlling the system. By making instruments co-adaptive, we can radically change how people use interactive systems, providing incrementally learnable paths that offer users greater expressive power and mastery of their technology. The initial goal of the CREATIV project is to fundamentally improve the learning and expressive capabilities of advanced users of creative software, offering significantly enhanced methods for expressing and exploring their ideas. The ultimate goal is to radically transform interactive systems for everyone by creating a powerful and flexible partnership between human users and interactive technology.

8.3.1.2. Unified Principles of Interaction

Program: ERC Advanced Grant

Project acronym: ONE

Project title: Unified Principles of Interaction

Duration: October 2016 - September 2020

Coordinator: Michel Beaudouin-Lafon

Abstract: The goal of ONE is to fundamentally re-think the basic principles and conceptual model of interactive systems to empower users by letting them appropriate their digital environment. The project addresses this challenge through three interleaved strands: empirical studies to better understand interaction in both the physical and digital worlds, theoretical work to create a conceptual model of interaction and interactive systems, and prototype development to test these principles and concepts in the lab and in the field. Drawing inspiration from physics, biology and psychology, the conceptual model combines *substrates* to manage digital information at various levels of abstraction and representation, *instruments* to manipulate substrates, and *environments* to organize substrates and instruments into digital workspaces.

8.3.1.3. Humane AI (801)

Title: Toward AI Systems That Augment and Empower Humans by Understanding Us, our Society and the World Around Us

Program: FET Flagships

Duration: March 2019 - February 2020

Coordinator: DFKI (Germany)

Partners:

Aalto Korkeakoulusaatio SR (Finland)

Agencia Estatal Consejo Superior De Investigaciones Cientificas (Spain)

Albert-ludwigs-universitaet Freiburg (Germany)

Athina-erevnitiko Kentro Kainotomias Stis Technologies Tis Pliroforias, Ton Epikoinonion Kai Tis Gnosis (Greece)

Consiglio Nazionale Delle Ricerche (Italy)

Deutsches Forschungszentrum Fur Kunstliche Intelligenz GMBH (Germany)

Eidgenoessische Technische Hochschule Zürich (Switzerland)

Fondazione Bruno Kessler (Italy)

German Entrepreneurship GMBH (Germany)

INESC TEC - Instituto De Engenharia De Sistemas E Computadores, Tecnologia E Ciencia (Portugal)

ING Groep NV (Netherlands)

Institut Jozef Stefan (Slovenia)

Institut Polytechnique De Grenoble (France)

Knowledge 4 All Foundation LBG (United Kingdom)

Kobenhavns Universitet (Denmark)

Kozep-europai Egyetem (Hungary)

Ludwig-maximilians-universitaet Muenchen (Germany)

Max-planck-gesellschaft Zur Forderung Der Wissenschaften EV (Germany)

Technische Universitaet Kaiserslautern (Germany)

Technische Universitaet Wien (Austria)

Technische Universitat Berlin (Germany)

Technische Universiteit Delft (Netherlands)

Thales SIX GTS FRANCE SAS (France)

The University Of Sussex (United Kingdom)

Universidad Pompeu Fabra (Spain)

Universita Di Pisa (Italy)

Universiteit Leiden (Netherlands)

University College Cork - National University Of Ireland, Cork (Ireland)

Uniwersytet Warszawski (Poland)

Volkswagen AG (Germany)

Inria contact: Wendy Mackay

The presence and capabilities of artificial intelligence (AI) have grown significantly and will continue to do so. The Humane AI Flagship will develop the scientific foundations and technological breakthroughs needed to shape the ongoing AI revolution. The goal is to deploy AI systems that enhance human capabilities and empower individuals and societies, and ultimately extend human intelligence (rather than replace it). With 35 partners from 17 countries, Humane AI is undertaking a preparatory action to draft an ambitious research agenda to provide competitive advantages to European industry and substantial benefits to society. Partners are united by the vision of a new generation of ethical, value-oriented, and human-centric European approach to AI.

8.4. International Initiatives

8.4.1. Participation in Other International Programs

8.4.1.1. Inria International Chairs

IIC MCGRENERE Joanna

Title: Personalization through Co-Adaptive Human-Computer Interaction

International Partner (Institution - Laboratory - Researcher):

University of British Columbia (Canada) - Dept of Computer Science - Joanna McGrenere

Duration: 2017 - 2021

8.5. International Research Visitors

8.5.1. Visits of International Scientists

Joanne McGrenere, Professor at the University of British Columbia, Canada and Inria Chair, visited for two months, to work with Wendy Mackay and Michel Beaudouin-Lafon.

Susanne Bødker, Professor at Aarhus University, Denmark, visited for a week to work with Wendy Mackay and Michel Beaudouin-Lafon.

8.5.1.1. Internships

Injung Lee, Ph.D. student from KAIST, South Korea, visited for five months to work with Michel Beaudouin-Lafon.

9. Dissemination

9.1. Promoting Scientific Activities

9.1.1. Scientific Events: Selection

9.1.1.1. Member of the Conference Program Committees

- ACM CHI 2020, *ACM CHI Conference on Human Factors in Computing Systems*: Theophanis Tsandilas
- ACM UIST 2019, *ACM Symposium on User Interface Software and Technology*: Michel Beaudouin-Lafon, Wendy Mackay
- ACM VRST 2019, *ACM Symposium on Virtual Reality Software and Technology*: Cédric Fleury
- EuroVR 2019, *EuroVR International Conference*: Cédric Fleury
- MOCO 2019, *International Conference on Movement and Computing*: Sarah Fdili Alaoui, Baptiste Caramiaux
- IHM 2019, *Conférence Francophone d'Interaction Homme-Machine*: Sarah Fdili Alaoui

9.1.1.2. Reviewer

- ACM CHI 2019-20, *ACM CHI Conference on Human Factors in Computing Systems*: Sarah Fdili Alaoui, Cédric Fleury, Baptiste Caramiaux, Michel Beaudouin-Lafon, Wendy Mackay, Julien Gori, Alexander Eiselmayer
- ACM UIST 2019, *ACM Symposium on User Interface Software and Technology*: Theophanis Tsandilas, Cédric Fleury, Julien Gori
- ACM DIS 2019, *Designing Interactive Systems*: Baptiste Caramiaux, Sarah Fdili Alaoui
- ACM ACII, : Baptiste Caramiaux
- IEEE VIS 2019, *IEEE Visualization Conference*: Theophanis Tsandilas, Michel Beaudouin-Lafon
- IEEE VR 2019-20, *Virtual Reality Conference*: Cédric Fleury
- ACM ISS 2019, *ACM International Conference on Interactive Surfaces and Spaces*: Theophanis Tsandilas

- ACM MobileHCI (2019) *The Conference on Human-Computer Interaction with Mobile Devices and Services*: Julien Gori
- ACM NordiCHI (2018) *The Nordic Conference on Human-Computer Interaction*: Julien Gori
- EURASP Eusipco (2019) *European Signal Processing Conference*: Julien Gori
- IEEE SMC (2018) *IEEE International Conference on Systems, Man, and Cybernetics*: Julien Gori
- ACM CHIPLAY 2019, *ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play*: Viktor Gustafsson
- IHM 2019, *Conférence Francophone d'Interaction Homme-Machine*: Theophanis Tsandilas, Wendy Mackay

9.1.2. Journal

9.1.2.1. Member of Editorial Boards

- Editor for the Human-Computer Interaction area of the ACM Books Series (published with Morgan & Claypool Publishers): Michel Beaudouin-Lafon (2013-)
- TOCHI, *Transactions on Computer Human Interaction*, ACM: Michel Beaudouin-Lafon (2009-), Wendy Mackay (2016-), Baptiste Caramiaux (2019-)
- PloS ONE: Baptiste Caramiaux (2018-)
- JIPS, *Journal d'Interaction Personne-Système*, AFIHM: Michel Beaudouin-Lafon (2009-)
- Frontiers in *Virtual Reality*: Cédric Fleury (2019-)

9.1.2.2. Reviewer - Reviewing Activities

- TOCHI, *Transactions on Computer Human Interaction*, ACM: Theophanis Tsandilas, Julien Gori
- ACM Books Series: Theophanis Tsandilas
- Frontiers in *Robotics and AI*, Virtual Environments section: Cédric Fleury

9.1.3. Invited Talks

- CIO Workshop, Sanderberg, Denmark *Generative Theories of Interaction (in the making)*, 23 January 2019: Michel Beaudouin-Lafon, Susanne Bødker, and Wendy Mackay
- Colloque CNRS Humain et Numérique en Interaction, Paris, *Aura-t-on encore besoin d'interagir avec des ordinateurs ?*, February 2019: Michel Beaudouin-Lafon
- Stanford University, Palo Alto CA *Human-Computer Partnerships*, 27 February 2019: Wendy Mackay
- IHM & AI Workshop, Paris *Partenariats Homme-Machines*, 14 March 2019: Wendy Mackay
- DYSTOPIA, Paris, *L'IA nous rendra-t-elle inhumains ?*, March 2019: Michel Beaudouin-Lafon
- Stanford University, *Unified Principles of Interaction*, March 2019: Michel Beaudouin-Lafon
- CHI 2019 Panel, Glasgow, Scotland *Rigor, Relevance and Impact: The Tensions and Trade-Offs Between Research in the Lab and in the Wild*, April 2019: Wendy Mackay
- MIT CSAIL, *Unified Principles of Interaction*, May 2019: Michel Beaudouin-Lafon
- SystemX, Paris *Partenariats Homme-Machines*, 29 May 2019: Wendy Mackay
- ESPGG, Open Lab Days, *Human-centred Machine Learning in Creative Applications*, June 2019: Baptiste Caramiaux
- University of London Institute, *AI in the Media and Creative Industries*, June 2019: Baptiste Caramiaux
- Aachen University Graduation Keynote *Human-Computer Partnerships*, 17 June 2019: Wendy Mackay
- Creative Industries & AI, Paris *Human-Computer Partnerships*, 21 June 2019: Wendy Mackay

- User Interfaces group, Aalto University, Finland, *A new take on the speed-accuracy tradeoff of Aimed Movements – Implications and Applications for HCI*, October 2019: Julien Gori
- ACM UIST Symposium, New Orleans, Visions talk *A World Without Apps*, October 2019: Michel Beaudouin-Lafon
- AI & Gender Equality Seminar, UNESCO, Paris *Does AI introduce new risks and opportunities for gender equality?*, 2 November, 2019: Wendy Mackay
- LIMSI, *Human-centred Machine Learning*, Novembre 2019: Baptiste Caramiaux
- University of Toronto TUX Sanders Series Talk, *Unified Principles of Interaction*, November 2019: Michel Beaudouin-Lafon
- IRCAM Paris, *State of The art of tools supporting dance learning*, ELEMENT workshop, 2019: Sarah Fdili Alaoui
- ENSAD, Paris, *Live Coding with interactive movement based technologies*, Virtual creativity collective realities, 2019: Sarah Fdili Alaoui
- Aarhus, Danemark, *Live Coding with interactive movement based technologies*, Performing Art Platform, 2019: Sarah Fdili Alaoui
- Aarhus University, Danemark, *Crafting dance and technologies*, 2019: Sarah Fdili Alaoui
- Conservatory of Vicenza, Italy, Workshop on *Music dance and interaction*, 2019: Sarah Fdili Alaoui
- Conservatory of Vicenza, Italy, Master class of *Creation with technologies*, 2019: Sarah Fdili Alaoui
- Stereolux, Nantes, France, Workshop on *Live Coding with interactive movement based technologies* at LAB-DAYS - MovA, 2019: Sarah Fdili Alaoui

9.1.4. Leadership within the Scientific Community

- Information Science and Technology (STIC) Department, Université Paris-Saclay: Michel Beauouin-Lafon (chair since June 2018), Wendy Mackay (member)
- Research division, Université Paris-Saclay: Michel Beaudouin-Lafon (advisor for Digital Sciences since June 2018)
- Digiteo RTRA research network, Université Paris-Saclay: Michel Beauouin-Lafon (director since June 2018)
- Computer Science Department, Université Paris-Sud: Michel Beaudouin-Lafon (vice-President for research)
- ACM Technology Policy Council: Michel Beaudouin-Lafon (vice-chair)

9.1.5. Scientific Expertise

International

- HCERES Evaluation: Wendy MAckay, external expert
- NSERC Evaluation: Michel Beaudouin-Lafon, external expert
- ACM SIGCHI “Lifetime Service Award” committee chair: Michel Beaudouin-Lafon
- ACM “Policy Award” committee adjunct chair: Michel Beaudouin-Lafon

National

- CNRS INS2I “Cellule ERC”: Michel Beaudouin-Lafon, member
- Agence Nationale de la Recherche (ANR), Appel à projets génériques: Sarah Fdili Alaoui, reviewer

9.1.6. Research Administration

Telecom ParisTech, “Comité de la recherche”: Michel Beaudouin-Lafon (member)

“Conseil de Laboratoire”, LRI: Wendy Mackay, Cédric Fleury (members)

“Commission consultatives paritaires (CCP)” Inria: Wendy Mackay (President)

“Conseil Scientifique”, LRI: Michel Beaudouin-Lafon (member)

CCSU, “Commission Consultative de Spécialistes de l’Université”, Université Paris-Sud: Michel Beaudouin-Lafon, Wendy Mackay (members)

“Commission Locaux”, LRI: Theophanis Tsandilas (member)

“Commission Scientifique”, Inria: Theophanis Tsandilas (member)

“Jury de recrutement, Maître de Conférences”, Télécom ParisTech: Michel Beaudouin-Lafon (member)

“Assessment committee for associate professors”, Aarhus University: Michel Beaudouin-Lafon (member)

“Comité de sélection, Maître de Conférences”, Université Paris-Sud: Cédric Fleury

9.2. Teaching - Supervision - Juries

9.2.1. Teaching

International Masters: Theophanis Tsandilas, *Probabilities and Statistics*, 32h, M1, Univ. Paris-Saclay

Interaction & HCID Masters & Innovation and Entrepreneurship Minor: Sarah Fdili Alaoui, Coordinator

HCID Masters: Sarah Fdili Alaoui, *Innovation & Entrepreneurship Advanced*, 15h, M2, Univ. Paris-Sud

HCID Masters: Michel Beaudouin-Lafon, Wendy Mackay, *Fundamentals of Situated Interaction*, 21 hrs, M1/M2, Univ. Paris-Sud

Interaction & HCID Masters: Sarah Fdili Alaoui, *Creative Design*, 27h, M1 et M2, Univ. Paris-Sud

Interaction & HCID Masters: Michel Beaudouin-Lafon, *Fundamentals of Human-Computer Interaction*, 21 hrs, M1/M2, Univ. Paris-Sud

Interaction & HCID Masters: Michel Beaudouin-Lafon & Cédric Fleury, *Groupware and Collaborative Interaction*, 31.5 hrs, M1/M2, Univ. Paris-Sud

Interaction & HCID Masters: Wendy Mackay, *Career Seminar* 6 hrs, M2, Univ. Paris-Sud

Interaction & HCID Masters: Wendy Mackay, *Design of Interactive Systems*, 21 hrs, M1/M2, Univ. Paris-Sud

Interaction & HCID Masters: Wendy Mackay, *Advanced Design of Interactive Systems*, 21 hrs, M1/M2, Univ. Paris-Sud

Interaction & HCID Masters: Baptiste Caramiaux, *Gestural and Mobile Interaction*, 24 hrs, M1/M2, Univ. Paris-Sud

Polytech: Cédric Fleury, *Projet Java-Graphique-IHM*, 24 hrs, 3st year, Univ. Paris-Sud

Polytech: Cédric Fleury, *Interaction Homme-Machine*, 18 hrs, 3st year, Univ. Paris-Sud

Polytech: Cédric Fleury, *Option Réalité Virtuelle*, 56 hrs, 5th year, Univ. Paris-Sud

Polytech: Cédric Fleury, *Réalité Virtuelle et Interaction*, 48 hrs, “Apprentis” 5th year, Univ. Paris-Sud

9.2.2. Supervision

PhD students

PhD: Philip Tchernavskij, *Designing and Programming Malleable Software*, Université Paris-Saclay, 3 December 2019. Advisors: Michel Beaudouin-Lafon

PhD: Yujiro Okuya, *CAD Modification Techniques for Design Reviews on Heterogeneous Interactive Systems*, 8 November 2019. Advisors: Patrick Bourdot (LIMSI-CNRS) & Cédric Fleury

PhD: Anna Gogolou, *Iterative and Expressive Querying for Big Data Series*, 15 November 2019. Advisors: Anastasia Bezerianos (ILDA-Inria), Themis Palpanas (Université Paris-Descartes) & Theophanis Tsandilas

PhD in progress: Stacy (Shu-Yuan) Hsueh, *Embodied design for Human-Computer Co-creation*, November 2015. Advisors: Wendy Mackay & Sarah Fdili Alaoui

PhD in progress: Jean-Philippe Rivière, *Embodied Design for Human-Computer Partnership in Learning Contexts*, October 2017. Advisors: Wendy Mackay, Sarah Fdili Alaoui & Baptiste Caramiaux

PhD in progress: Yiran Zhang, *Telepresence for remote and heterogeneous Collaborative Virtual Environments*, October 2017. Advisors: Patrick Bourdot (LIMSI-CNRS) & Cédric Fleury

PhD in progress: Téo Sanchez, *Co-Learning in Interactive Systems*, September 2018. Advisors: Baptiste Caramiaux & Wendy Mackay

PhD in progress: Elizabeth Walton, *Inclusive Design in Embodied Interaction*, November 2018. Advisor: Wendy Mackay

PhD in progress: Miguel Renom, *Theoretical bases of human tool use in digital environments*, October 2018. Advisors: Michel Beaudouin-Lafon & Baptiste Caramiaux

PhD in progress: Han Han, *Participatory design of digital environments based on interaction substrates*, October 2018. Advisor: Michel Beaudouin-Lafon

PhD in progress: Viktor Gustafsson, *Co-adaptive Instruments fo Game Design*, October 2018. Advisor: Wendy Mackay

PhD in progress: Yi Zhang, *Generative Design using Instrumental Interaction, Substrates and Co-adaptive Systems*, October 2018. Advisor: Wendy Mackay

PhD in progress: Martin Tricaud, *Instruments and Substrates for Procedural Creation Tools*, October 2019. Advisor: Michel Beaudouin-Lafon

PhD in progress: Arthur Fages, *Collaborative 3D Modeling in Augmented Reality Environments*, December 2019. Advisors: Cédric Fleury & Theophanis Tsandilas

Masters students

Clément Sauvard, "*Designing 3D Scenes with multiple AR views*": Cédric Fleury & Theophanis Tsandilas

Cyril Crebouw, "*Remote collaboration across wall-sized displays*": Cédric Fleury & Michel Beaudouin-Lafon

Ellen Sigloch, "*Prototips website*": Wendy Mackay

Yuyan Jing, "*Coadaptive Map: A Design tool for GIS users*": Wendy Mackay

Alina Nicolae, "*TweakyTemplate: Reifying template tweaks for book design*": Wendy Mackay

Wuji Geng, "*Studies of the Interaction Museum: The gap between HCI research and practice*": Wendy Mackay

Xi Hu, "*Motion Palette: Motion Exploration Support Tool for Dynamic Visual Effects*": Wendy Mackay

Siba Siddique, "*Investigating User Decision in Human-AI Interaction*": Baptiste Caramiaux

9.2.3. Juries

PhD theses

Sylvain Pauchet, University of Toulouse/ENAC "*From surface to surface: Transformations de surface tactile pour l'interaction incarnée dans le cockpit*" (advisor: Stéphane Conversy): Wendy Mackay, reviewer

Hugo Scurto, IRCAM/Sorbonne University "*Designing With Machine Learning for Interactive Music Dispositifs*" (advisor: Frédéric Bevilacqua): Wendy Mackay, reviewer

Emmanouil Giannisakis, Télécom ParisTech, "*Promoting and characterizing the menu to keyboard shortcuts transition*" (advisor: Gilles Bailly): Theophanis Tsandilas, examiner

Julien Casarin, Université de Strasbourg, "*Proposition d'un protocole web pour la collaboration multi-support en environnement 3D*" (advisor: Dominique Bechman): Michel Beaudouin-Lafon, president

Emmanouil Potetsianakis, Télécom ParisTech, "*Amélioration des applications vidéo grâce aux métadonnées temporelles*" (advisor: Jean Le Feuvre): Michel Beaudouin-Lafon, examiner

Maxime Garcia, Université Grenoble Alpes, Inria Rhones Alpes, "*Transfert d'animation : animer des personnages virtuels par le jeu et le mime*" (advisor: Rémi Ronfard): Sarah Fdili Alaoui, invited examiner

9.3. Popularization

9.3.1. Articles and contents

- Radio show "Les P'tits Bateaux" on France Inter public radio: Michel Beaudouin-Lafon (interviews in response to children questions on 5 May, 30 June, 18 August, 24 November 2019)

9.3.2. Education

- Chapter about the Web in a textbook for high-school students: Michel Beaudouin-Lafon [36]

9.3.3. Interventions

- Presentation of research work on dance movement during the dance show "Frame(d)", at Micadance (25 May 2019) and SUAPS Paris-Sud (June 2019): Rivière Jean-Philippe
- Université Paris-Saclay Learning Center: art-science project with photographer Didier Goupy presenting the portraits of Ph.D students of Université Paris-Saclay. Ph.D. graduation ceremony, Université Paris-Saclay, June 2019; Fête de la Science, Gif-sur-Yvette, October 2019

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