

## PREFACE

It is our great pleasure to present the proceedings of the First International Conference on Tangible and Embedded Interaction. This new conference addresses interaction, design, tools, use, and art, especially encouraging interdisciplinary research spanning these themes.

For its inaugural year, TEI'07 is held in concert with the 14<sup>th</sup> Annual Mardi Gras conference at Louisiana State University in Baton Rouge, Louisiana. Major sponsorship is provided by the LSU Center for Computation and Technology (CCT). The conference is in cooperation with ACM SIGGRAPH, with its proceedings to be archived in ACM's Digital Library.

The Mardi Gras festival finds its roots some 5,000 years ago as a celebration of spring. In North America, the festival dates to French explorers' arrival at the mouth of the Mississippi River in 1699. Just south of New Orleans, where the river meets the sea, they named their landfall Point d'Mardi Gras, on occasion of the day.

In this spirit of new life, discovery, cultural diversity, and celebration, each spring the Mardi Gras conference embraces a different theme of regional interest and relevance. This year, we have embraced tangible and embedded interaction, with aspirations of giving birth to a recurring annual gathering and celebration of research in this field.

## Tangible and Embedded Interaction

With technological advances, computing is progressively moving beyond the desktop into diverse physical and social contexts. As physical artifacts gain new computational behaviors, they become reprogrammable, customizable, repurposable, and interoperable in rich ecologies. They also become more complex, requiring intense design effort to become functional, usable, and enjoyable. Designing such systems requires interdisciplinary efforts. Their creation must not only encompass software, electronics, and mechanics, but also the system's physical form and behavior, its social and physical milieu, and beyond.

Research on tangible and embedded interaction has gained substantial visibility and activity over the past decade. The research has worn many names, including tangible interfaces, graspable interfaces, physical computing, tangible interaction, IT product design, appliance design, interactive spaces, cooperative buildings, and others. These efforts have been associated, and often interwoven, with other major research areas including mixed, virtual, and augmented reality, as well as ubiquitous and pervasive computing.

With this conference, we aim to bring together researchers, students, designers, practitioners, and artists from academia and industry who are concerned with envisioning, creating, implementing and using novel interactive systems and with understanding their use and impacts on application areas. The conference provides a venue to present state-of-the-art research in this field, and to openly and inclusively discuss topical ideas and open questions.

We anticipate that by bringing together different viewpoints, ranging from computing, hardware, and sensor technology, to HCI, interaction design, and CSCW, to product and industrial design and interactive arts, a common understanding can emerge. Sharing different perspectives – theoretical, conceptual, technical, applied, and artistic – we seek to collectively make a significant step in fostering a community in Tangible and Embedded Interaction.

## Submissions

The conference received 93 submissions from 20 countries and 5 continents. The quality, novelty, and originality of submitted work well exceeded our expectations.

Our call for papers instructed authors to choose the length of their paper to suit the research described. Submissions could have 2, 4 or 8 pages, and all underwent the same review process, with weighting as equal contributions. Papers are presented at the conference in different formats – demo/exhibit, oral presentation, poster presentation – independent of their length. After review and deliberation, 50 contributions from 15 countries were accepted. The papers are published in this proceeding, which is jointly edited by the program and conference chairs. All included papers are archived and will be available in the ACM Digital Library.

The selection of contributions for inclusion in the program was based on peer review. Each paper received at least three expert reviews, provided through the efforts of the more than sixty Technical Program Committee members and additional expert reviewers. For every paper with at least one positive review, the program chairs read and discussed all reviews. Decisions were based on reviewer scoring and comments. For each accepted paper, the form of presentation was determined based upon author preferences, reviewer comments, and space and time constraints.

## Chapters

Through the efforts of our authors, we feel we have achieved our objective of a body of work representing the diverse approaches, viewpoints, and research issues in our field. The proceedings' division into chapters emphasizes common topics across disciplinary approaches – e.g., the integration of virtual and physical elements, connectedness, and the physical adaptability of systems.

### *Connectedness:*

Tangible and embedded artifacts can embody and mediate connections between people or between objects in physically removed places. Allowing for tacit or explicit communication and interaction, they can provide tangible input mechanisms for digital distributed media, and may themselves consist of distributed and connected elements. Connectedness is both a means and an end, as the papers of this chapter demonstrate.

### *Integrating the virtual and the physical:*

One major goal in TEI design concerns the integration of virtual, digital elements within the real world we physically inhabit. Papers in this chapter discuss and present technical means to accomplish this integration, including toolkits for prototyping; application areas such as home messaging for families; innovative applications and systems; and provoke us by animating an unexpected physical material: meat.

### *The Expressive Character of Interaction:*

Enhancing the expressive potential of systems, and exploring new modalities of expression, involve technical as well as aesthetic design challenges, together with an understanding of how people 'read' and understand these expressions. Papers in this chapter address the contribution of 'research through design' to understanding expressive interaction; users' cognitive understanding of physical metaphors; and the use of diverse materials as input/output modalities and expressive media.

### *Learning through physical interaction:*

Many past papers have considered the use of tangible interaction within educational applications. Physical interaction is said to enhance learning and foster cognitive development. Yet our understanding remains limited – how do these processes take place; which factors of systems or chosen problem representations are vital; and how significant are the prospective advantages? These articles provide evidence and arguments both pro and con. Offering success stories as well as sceptical views, they describe compelling example systems as well as field studies, uncovering design challenges that must be met before educational applications can be successful.

### *Context dependency and physical adaptability:*

When we integrate the physical with the digital, users must physically move to interact, and the system itself may also move – either by itself, or through physical adaptation and configuration by users. Papers discuss how tangible interaction might ease the configuration of large systems; describe mechanisms for sensing and analysing interaction with objects; and bridge to robotics and architecture.

### *Body Movement:*

Human movement plays an important role in tangible and embedded interaction, both as input medium and as part of the design approach. Wearable and mobile devices may be manipulated and controlled via body movement, and simultaneously provide physical feedback to the users' body. Movement can span diverse physical scales – e.g., strolling through a city, vs. the tap of a hand. Designing for human movement requires us to understand the role of the body, and to develop design methods that help designers focus on the quality of movement.

## **Cover**

With the cover design, we have attempted to illustrate several themes synergistic with the conference. In the evolutionary tree, we express the long, rich evolution of both topical projects and broader themes. As with biology, some efforts have been highly fruitful; others, niche artifacts or perhaps dead ends.

Among the former, we pay respect to one particular system: the Marble Answering Machine of Durrell Bishop, envisioned in 1992 while a student at the Royal College of Art Computer Related Design program. While not the “first” tangible interface, it has proven highly influential, including inspiring several of the chairs to enter the field.

It is worth noting that Bishop strongly felt his Machine should not stand on its own, but rather as one of a diverse ecology of interconnected, interoperating tangibles. The technical, conceptual, and design challenges of this goal are significant, as evidenced by a plethora of “point systems.” Nonetheless, we believe such ecologies likely still represent much of the future and potential of tangible and embedded interaction – hence our celebration of the Marble Answering Machine as both an enduring vision, and eyeglasses to possible futures.

## **Acknowledgments**

We greatly appreciate and warmly thank the many people who have worked to make TEI'07 possible. We recognize and appreciate Tom Rodden for serving as the inaugural keynote speaker. We warmly thank the TEI 2007 Technical Program Committee members and additional expert reviewers for promoting the conference, reviewing papers, and selecting the work that composes this proceedings.

We appreciate the Local Organizing Committee – especially Event Manager Karen Jones; student leads Matthias Kranz, Srikanth Jandhyala, Rajesh Sankaran, and Blake Tregre; and all participating student volunteers. Sebastian Boring and Paul Holleis served as web masters. Brygg Ullmer designed the proceedings cover. The chairs appreciate support from their home institutions. Three chairs have transitioned during preparation, and thank their past affiliations – Ludwig-Maximilians-Universitaet Munich; Human Interface Technology Lab New Zealand; and Technische Universiteit Delft – for highly valued support.

We warmly appreciate major sponsorship from the LSU Center for Computation and Technology (CCT), hopefully in collaboration with additional sponsors (which we are still seeking at the time of press). Finally, we appreciate Adrienne Griscti and Deborah Cotton of ACM for their support.

We hope this is the first volume in a series of TEI Proceedings, and that the conference will be successfully continued in the future. We look forward to TEI'08, for which planning has already begun at this writing. For further information on the conference series, see [www.tei-conf.org](http://www.tei-conf.org).

**Conference chairs:**

Brygg Ullmer	Louisiana State University	Baton Rouge, Louisiana, USA
Albrecht Schmidt	B-IT Center and Fraunhofer IAIS	Bonn, Germany

**Program chairs:**

Eva Hornecker	The Open University	Milton Keynes, United Kingdom
Caroline Hummels	Eindhoven Univ. of Technology	Eindhoven, the Netherlands
Robert J. K. Jacob	Tufts University	Medford, Massachusetts, USA

**Publication chair:**

Elise van den Hoven	Eindhoven Univ. of Technology	Eindhoven, the Netherlands
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*Baton Rouge, Louisiana, February 2007*