Tangible Meets Gestural: Comparing and Blending Post-WIMP Interaction Paradigms

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Abstract
More and more objects of our everyday environment are becoming smart and connected, offering us new interaction possibilities. Tangible interaction and gestural interaction are promising communication means with these objects in this post-WIMP interaction era. Although based on different principles, they both exploit our body awareness and our skills to provide a richer and more intuitive interaction. Occasionally, when user gestures involve physical artifacts, tangible interaction and gestural interaction can blend into a new paradigm, i.e., tangible gesture interaction [5]. This workshop fosters the comparison among these different interaction paradigms and offers a unique opportunity to discuss their analogies and differences, as well as the definitions, boundaries, strengths, application domains and perspectives of tangible gesture interaction. Participants from different backgrounds are invited.

Keywords
Tangible interaction; gestural interaction; physical gestures; embodied design; tangible gestures.

ACM Classification Keywords
H5.2. Information interfaces and presentation: User interfaces, Interaction styles, User-centered design.

Introduction

Since Weiser's vision of ubiquitous computing [14], many branches of Human-Computer Interaction (HCI) have tried to obtain a seamless and digitally augmented interaction with the physical world. Jacob et al. formalized the transition from the Windows Icon Mouse Pointer (WIMP) paradigm to the post-WIMP era with Reality Based Interaction (RBI), which takes advantage of human natural skills to interact in the real world [7]. Tangible interaction and gestural interaction both benefit from the RBI theme Body Awareness & Skills [10] and allow moving the interaction beyond the screen. Since the origins of tangible interaction, many researchers considered gestures as a communication means in Tangible User Interfaces (TUIs). Fitzmaurice's PhD thesis on graspable user interfaces states: "By using physical objects, we not only allow users to employ a larger expressive range of gestures and grasping behaviors but also to leverage off of a user's innate spatial reasoning skills and everyday knowledge of object manipulations" [4]. A few years later, Fishkin wrote that tangible interfaces "all share the same basic paradigm—a user uses their hands to manipulate some physical object(s) via physical gestures; a computer system detects this, alters its state, and gives feedback accordingly" [3]. Still in Radical Atoms [6], Ishii's latest vision of tangible interaction, gestures and direct manipulation are the two modalities that allow the users to control the system. Similarly, gestural interaction is often associated to the manipulation of physical objects. Gesture can animate objects such as the Nintendo WiiMote or the Sony PSMove, "reinventing" the identity of the controller [13]. Ferscha et al. [2] framed tilting gesture with different types of physical artifacts, while Song et al. [11] showed how different grips and touch gestures could be used to change the inking mode of a pen.

The relative influences of the two paradigms suggest that it is possible to blend tangible interaction and gestural interaction in richer interaction paradigms that exploits at the same time our ability to communicate through gestures and our ability to manipulate objects of the real world. Vaucelle and Ishii theorized this new paradigm for the first time in 2008 as Gesture Object Interfaces [13]. In 2010, Van den Hoven and Mazalek [5] defined tangible gesture interaction at the intersection of gestural interaction and tangible interaction, bridging both our ability to think and communicate through our bodies and our manipulative skills. Van den Hoven and Mazalek [5] gave several examples and application domains of tangible gesture interaction. In order to explore the design space of gesture with objects, Valdes et al. [12] and Angelini et al. [1] have conducted two user elicitation studies. Both studies found a large variety of possible gestures, respectively with active tokens and the steering wheel, but they also noticed a strong influence of gestures typical of smartphones and tablets, such as swiping and tapping. This is consistent with the recent theory of blended interaction [8], which suggest that users blend concepts not only from their knowledge of the physical world such as in RBI [7], but also from their previous knowledge of existing interactive systems. Although smartphone gestural interfaces are more intuitive and richer than WIMP interfaces, they still do not support our ability to manipulate objects and they generally exploit only one or two fingers. Obviously, this

perspective worries the TEI community and indeed this TEI'15 workshop aims at demonstrating that tangible gesture interaction can offer a richer experience to users than traditional GUI based interaction. Within this context, this workshop offers an opportunity to discuss the current trends of tangible and gestural interactions, evidencing the advantages and limitations offered by both paradigms and the possibilities and risks that arises by blending them in tangible gesture interaction.

Workshop Proposal

The workshop aims at gathering around 15-20 participants. We encourage the participation of young practitioners but also more experienced researchers from different backgrounds (design, engineering, computing, arts, social sciences, neurosciences, ergonomics, etc.), with previous experience in tangible interaction or gestural interaction, or both. Workshop participants are invited to submit 3 to 6 page position papers that cover one or more topics suggested in the call for papers. In the first part of the workshop, the participants will briefly present and discuss their contributions. The following parts of the workshop will benefit of engaging hands-on design experiences to reason about tangible interaction, gestural interaction and tangible gesture interaction. Those design challenges aims at enhancing everyday objects with interactive capabilities. The participants, divided into small groups, will design simple tangible or gestural interfaces for digital interaction with everyday objects. This activity will take the form of a design competition in order to stimulate participants' involvement and creativity. Workshop organizers will rate the designs according to the number of interactions, their quality and the originality of the application; a live ranking updated each 15 minutes will help stimulate creativity.

The analysis of the hands-on phase results will allow participants to find analogies and differences between the two interaction paradigms. Then, after a second design competition, similar to the first one but applied to tangible gesture interfaces, participants will try to blend the two interaction paradigms and will discuss the definition, boundaries, strengths, limitations, application domains and perspectives of tangible gesture interaction.

Workshop Topics to be Covered

The topics of the workshop and of the participants' papers could include, but are not limited to:

- Theory and ground knowledge that frames gestural and tangible interaction
- Application of existing post-WIMP frameworks in tangible and gestural interaction
- Comparison of gestural and tangible interfaces (user performances, cognitive load, fatigue, learnability, skill development etc.) in specific application domains
- Expressivity of tangible and gestural interfaces
- Physical and psychological implications of human senses and skills involved in tangible and gestural interactions
- Feedback and feedforward for tangible and gestural interaction
- Novel applications for tangible gesture interfaces
- Theory, frameworks and future visions on tangible gesture interaction

- Techniques for mixed gesture and object recognition

Workshop Learning Goals

This workshop aims at building a community around the emerging field of tangible gesture interaction. The workshop will allow participants to see different points of view about gestural and tangible interaction from people with different backgrounds, enriching not only their personal experience but also the community's knowledge as a whole. Indeed, the insights generated during the workshop will support the advancement of the field of tangible gestural interaction and the results of the workshop will be shared with the scientific community. Moreover, the hands-on phases will allow tinkering with tangible gesture interfaces, individuating new applications for interactive objects.

Workshop Supporting Web Documents

A dedicated website at www.tangiblegestures.com will provide all the relevant information to the participants and will host the accepted workshop papers. The website will be a point of reference for the community and will publicize other future events on the topic of tangible gestures.

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