Multi-touch is Dead, Long live Multi-touch

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Abstract

Interest in multi-touch interaction with large and small displays surfaces has seen a recent explosion. We describe key moments in "multi-touch's" latest history and rank "multi-touch" in Gartner's five-phase hype cycle. We also (re)highlight the issues that designers have to take into account when designing multi-touch applications on multi-touch sensitive surfaces to address the ensuing period of "disillusionment". At this peak in the hype, many well-known concepts of multi-touch and bimanual interaction were ignored and we describe these low points for interaction design. Bill Buxton's multi-touch webpage provides a list of these "traps'' of which people who are starting out with multi-touch interaction should be aware. Based on Buxton's framework, we draw conclusions about how researchers should assess and be inspired to develop the next generation of multi-touch applications.

Introduction

"Le Roi est mort, vive le Roi" (English: The King is dead, long live the King) was first declared upon the coronation of Charles VII following the death of his father Charles VI in 1422. The phrase arose from the law of "le mort saisit le vif" – that the transfer of sovereignty occurs instantaneously upon the moment of death of the previous monarch [9] thereby
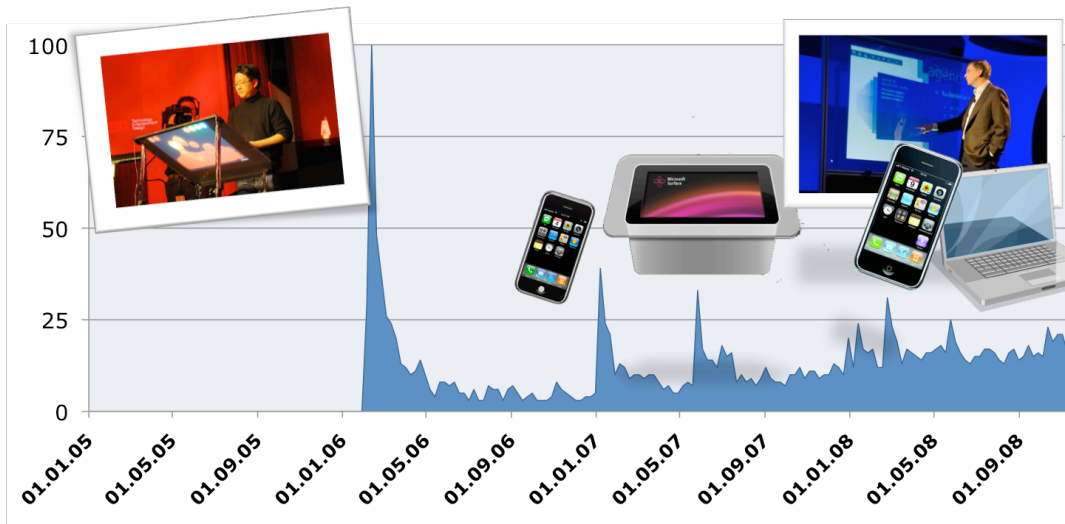
Figure 1: The attention of the term "multi-touch" analyzed with Google Trends. The data is scaled (fixed) based on the average search traffic of the term.
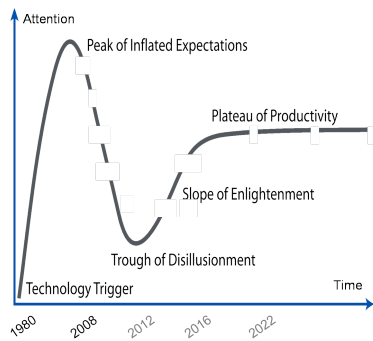

Figure 2: Gartner`s five phase hype cycle: Adapted for multi-touch based on a diagram by Jeremy Kemp [8].

as Frustrated Total Internal Reflection (FTIR) and Diffused Illumination (DI), have allowed for the low cost development of such surfaces, have led to a number of technological and application innovations. Han's rediscovery and dissemination of the FTIR principle [3] has greatly accelerated the development of new multi-touch applications and attention in the news media. In particular, his demonstration of a range of creatively applied multi-touch interaction techniques. In 2007, Apple presented their first mobile phone, the iPhone. Where other touch-based cellular phones only allow single point interaction, the iPhone used multi-touch technology. The iPhone's multi-touch interaction capabilities and the associated interfaces were a key component of Apple's marketing campaign and generated considerable media attention. Later in 2007, Microsoft presented their deployment of multi-touch, MS Surface. This multi-touch table has the appearance of a coffee table with an interactive surface. The sensing technique used in MS Surface is similar to the HoloWall [5] exploiting a diffuser, which is attached to the screen material.

Interesting, Google Trends [2] (figure 1) does a good job of capturing the recent rise of multi-touch. Gartner's hype cycle provides a historically grounded account of the cycle rise, fall and mundane utilisation of technologies, and in these terms it can be argued that "multi-touch" has hit the peak of "Inflated Expectations" and shall soon enter the "Trough of Disillusionment" (figure 2). All those with an intellectual investment (and belief) in multi-touch would like to minimize the time in this phase and push multi-touch onto the "Plateau of Productivity". Multi-touch has great potential for exploring complex content in an easy and natural manner. In general, tangible user

preserving the monarchy and maintaining the continuity of the State.

In terms of multi-touch interaction research we think of "Jeff Han" as our Charles VI of the year 2006; he took assumed the crown after nearly 25 years of multi-touch research. Indeed, before Han uploaded his research video on YouTube, "multi-touch" had the esoteric ring of many other hundreds of terms in human-computer interaction that are unlikely to impact on the everyday experience of real computer users. In 2005 Han [3] presented his low cost camera-based multi-touch sensing technique. His YouTube demonstration captured the imagination of researchers and users alike. Technologies that allow the low-cost implementation of robust multi-touch interaction, such
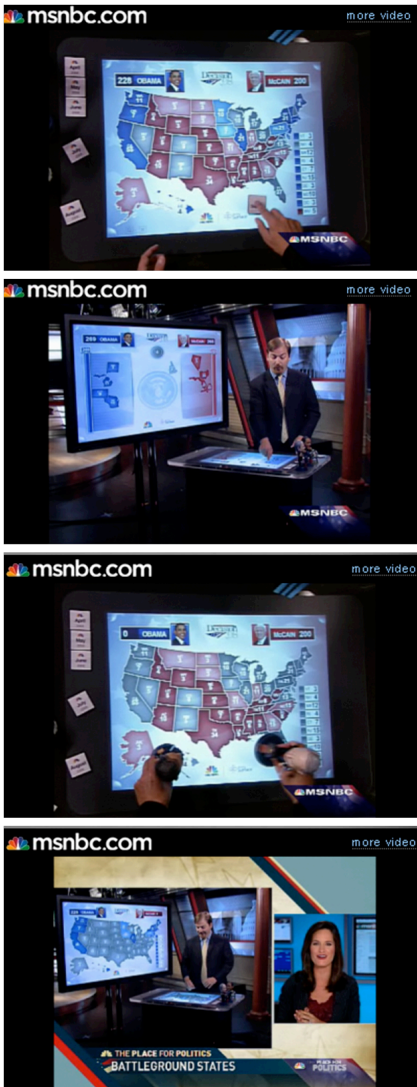
Figure 3: MS surface presented in a MSNBC election show early September 2008.

interfaces provide physical form to digital information and computation [7]. People have developed sophisticated skills for sensing and manipulating their physical environments. However, most of these skills are not employed in interaction with the digital world today. Surprisingly many applications using a multi-touch enabled surface fall well short of utilising the full potential that multi-touch interaction has to offer, and are contributing to the impending phases of "Disillusionment".

Multi-Touch in the News

More and more demonstrations and video of multi-touch systems are shown in news and media. Starting with Jeff Han's YouTube video initiated a theatre for researchers to show off their technologies and applications. The Microsoft Surface premiered on MSNBC News in early September 2008 in a U.S. election application. During the six-minute premiere, this great piece of technology was presented without *the use of a single multi-touch gesture* (see figure 3). Even though there was the possibility to integrate multi-touch gestures, e.g. dragging the states for the candidates simultaneous to the political parties (figure 3 (ii)), the demonstrator, Chuck Todd, did stuck to conventional and familiar interface actions. Even in the demonstration of a particularly strong feature of the surface, its ability to detect objects, the demonstration used the placement of single puppets of the candidates on the surface (showing the state that will vote for one candidate (figure 3 (iii)). Despite the innovative nature of Microsoft Surface these unimaginative demonstrations leave such system open to the common ridicule of "new technology for the sake of technology", and comedians are quick to comment — Saturday Night Live's Fred Armisen makes CNN's "Magic Map" look

genuinely silly[1]. Of course, there is a big different between a national news anchorman presenting the technology and an expert and entrepreneur such as Jeff Han. But is developing good applications is not a trivial enterprise, even if the underlying technology is becoming so. While everybody is able to build a multi-touch surface, developers must reflect on why they are doing so. Even computing science researchers have little regard for history as evidenced by the general surprise at Krueger's presentation of Videoplace/Videodesk [4] in his keynote at IEEE Tabletop 2008. As Kruger showed, many of the core ideas in multi-touch interaction were already established in 1983. Indeed, Bill Buxton's multi-touch webpage provides a list of "traps'' that people starting out with multi-touch interaction should be aware of.

Bill Buxton's Dogmas and Framing

The whole framing and the dogmas can be found online [1] and these should be required reading for developers of multi-touch technology. Firstly, be aware that "size matters", that there is a different between "Single-finger vs. multi-finger", "Multi-point vs. multi-touch" and "Multi-hand vs. multi-finger Multi-person vs. multi-touch" interaction. Furthermore, there is a difference between "Point and Gesture", and combining multi-touch hand and foot interaction has a couple of advantages and helps us to rethink the use of the dominant and non-dominant hand. In pure multi-touch hand interaction systems, the non-dominant hand often sets the reference frame that determines the navigation mode, while the dominant hand carries out the precise task. Since in this case one touch is only used to define

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[1]   http://www.engadget.com/2008/10/24/snl-does-multitouch-comedy-to-perfection-with-cnns-magic-map/

Figure 4: Multi-touch projects: FireFly Game demo on MS surface, the City Wall project by [6], and a multi-touch wall in a pedestrian underway during the exhibition "Hightech Underground" in Münster, Germay.

a certain mode, the advantages of multi-touch are not fully exploited.

Conclusion

Our goal is to motivate better application of multi-touch by pointing out the many disappointing presentations of multi-touch enabled surfaces and lack of awareness of genuine advantage of multi-touch interaction. Of course there are also many good examples of less high-profile multi-touch applications (see figure 4), e.g. the Firefly (again demonstrated on an MS Surface), or the City Wall project [6] that installed a large multi-touch surface directly into a pedestrian precinct. We are, of course, motivated by our own experiences of deploying such technologies. In particular, during an exhibition of our own FTIR based multi-touch wall in a pedestrian underpass. We allowed users to navigate through a virtual globe and explore POIs. Only a few people of the 1500 users of the application recognized that there was a multi-touch gesture to tilt the view on the earth. Unsurprisingly, people stuck with familiar WIMP interactions. It was interesting to see, that our application, designed for a single user, was used by groups of people with one actor often leading the group and compared to the Citywall project having [6] the same (even a bit more) interaction between the people interacting with the wall.

Despite these innovations many open questions for researchers remain: What are the benefits of multi-touch systems over single-touch systems? What are suitable applications? What kinds of applications are adequate for multi-touch systems? Are there more interaction possibilities than "just'" rotating and scaling photos or zooming into maps? According to the title of

this paper we would like to encourage developers to take care of following "coronation" rules:

- Let non-experts explore your systems (like in the City wall project, which got a lot of interesting results).
- Design interfaces that help users forget WIMP.
- Design systems that can only used by performing multi-touch gestures to investigate the advantages against single-touch systems.
- Do less lab studies and give the technology to users and test it in the wild.

As Buxton says: "Remember that it took 30 years between when the mouse was invented by Engelbart and English in 1965 to when it became ubiquitous"- we want to underline this and let multi-touch become a genuine useful technology that successfully passes through the inevitable hype.

"Multi-touch" will have a lot of next Kings, and with care, none of them will be Karl X of France.

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