Embodiment, Immediacy and Thinghood in the Design of Human-Computer Interaction

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Abstract

This paper is concerned with the design of Human-Computer Interaction (HCI). It criticizes the position that proposes 'Embodied Interaction' to be the underlying principle of the transition from textual, to graphical, to tangible interfaces.

Firstly, it is hypothesized that it is not the level of embodiment that has increased, but the level of immediacy. It is furthermore proposed that the concept of thinghood, as described in the works of Heidegger, is a fruitful starting point for the design of human-computer interfaces.

In the second part of this paper, the recent history of HCI practice is reviewed, with regard for its involvement of embodiment, immediacy and thinghood. It is then argued that embodiment has always been there unchangedly, while immediacy and thinghood have changed – not only in degree, but also in kind.

In the third part, three projects are reported. Each of the projects researches, through design, the physical display of digital entities. The projects do so by picking up Heidegger's characteristics of thinghood: extendedness, substantiality, and proximity.

It is concluded that making digital entities physically graspable can help us to make the immaterial accessible and, in doing so, ready-to-hand.

Keywords

embodiment; design; HCI; thinghood; immediacy; philosophy.

Human-Computer Interaction (HCI) has been dominated by Graphical User Interface (GUI) for the past two decades. Recent positions, however, postulate that a transition is in progress: From graphical to embodied interaction (Dourish, 2001).

A trend can indeed be observed in recent developments, for instance in Tangible User Interfaces (TUIs) (Ishii & Ullmer, 1997), in Natural User Interfaces (NUIs) (Seow et al., 2009), and in Reality-Based Interfaces (RBIs) (Jacob et al., 2008). However, this paper proposes that, in such developments, it is not the level of embodiment that increases, but, instead, changes occur in the levels and kinds of immediacy and thinghood.

A definition of 'Embodied Interaction' can be found in Dourish's work 'Where the Action is: The Foundations of Embodied Interaction' (Dourish, 2001), as the combination of 'tangible computing and social computing'.

While embodiment may seem suitable to conceptualize the current trend in HCI, this paper proposes two alternatives: immediacy and thinghood.

Immediacy

Immediacy is a term used in media theory. Bolter and Grusin refer to immediacy as a form of remediation (Bolter & Grusin, 2000): According to Bolter and Grusin, remediation can be observed in the transition between developmental phases of media (e.g. from painting to photography) and takes one of two forms: hypermediacy and immediacy.

'Hypermediacy' refers to the vanishing of content behind a type of media – for example, the vanishing of what can actually be seen on Niépce's first photographs behind what is visible in the second place: the potential of photography as a media itself.

Immediacy, on the other hand, refers to the vanishing of the media behind the content. In the progress of media adoption, a type of media can become, according to Bolter and Grusin, sufficiently integrated into a beholder's experience to allow him to focus on the content.

A similar notion can be found in 20th century existential philosophy. Heidegger coined the term ready-to-hand, for tools that 'become one with us' and thereby vanish in their usage (as compared to present-at-hand). It might be interesting to see parallels between these concepts and Bolter and Grusin's work.

Another Heideggerian term that could be of potential utility in HCI is thinghood, which will be elaborated on in the following section.

Thinghood

In 'Being and Time' (Heidegger, 1927), Heidegger introduces a set of three characteristics for thinghood. It consists of extendedness, substantiality, and proximity.

Extendedness

Heidegger notes extendedness to be one central property of thinghood (Heidegger, 1996, p. 96). Malpas adds, with regard to spatiality, that Heidegger uses '(...) space as that realm of extendedness in which a multiplicity of (...) entities [,] can be located' (Malpas, 2007, p. 48). But which other 'realms of extendedness' do exist, if not spatial ones?

He also points to an inherent structure of containment: The 'place' or topos of a thing is thus understood to be the inner surface of the body (where 'body' here means simply the thing in its physical extendedness) within which that thing is enclosed (Malpas, 2007, p. 69).

Malpas points out that 'Heidegger does indeed distinguish between two senses of spatiality – (…) objective spatiality (…) [and] (…) situatedness (…)'. He continues to elaborate on the latter: '[N]o conception of space as objective will be adequate to the understanding of that situatedness – objective space allows only for standardized 'locations', not for situatedness as such. The result is that we cannot treat situatedness as based in the measurable extendedness, and yet, since situatedness also has a spatiality of its own, we must distinguish between space understood in 'objective' terms and an alternative conception of space, (...) which we can refer to as 'existential.' (Malpas, 2007, p. 79)

'If there is any sense in which the bodily being of being-there is spatial, then, it is in a sense that is secondary to temporality in much the same way as the various modes of spatiality are also secondary. For this reason, Heidegger is unable to give any central place in his analysis to embodiment - indeed, since he has already committed himself to the dependent character of extended spatiality from almost the beginning of his analysis, the body as such simply falls outside the frame of Heidegger's discussion. (...) the body is secondary in the structure of being-there, (...) it threatens to make being-there into something spatial. (...) spatiality also threatens the loss of any sense of the 'there' in the stretched-out dimensionality of pure extendedness' (Malpas, 2007, p. 129).

What Malpas proposes here is that Heidegger's view of extendedness is two-fold: A spatial perspective, and an 'existential', conceptual perspective. The two of these will be taken into consideration when historically reviewing HCI practice for its usage of extendedness.

Proximity

Citing Heidegger, Malpas defines Proximity as 'simple and immediate presence' (Malpas, 2007, p. 56). He continues: 'The structure of equipmentality establishes, and indeed consists in, an ordering of things and thereby establishes a certain structure of relations in which things are brought into proximity with one another.' What becomes clear here is that no human is required for proximity, merely 'two things'.

Malpas adds: 'However, that structure, although it consists in certain places and regions, does not, as such, establish anything as proximate to Being-there - indeed, that structure does not itself bring any particular 'there' with it. The structure of equipmentality is thus an ordering of things (...).' (Malpas, 2007, p. 85)

Malpas also adds that proximity an inherent facet of 'place' is: 'Occurrence 'in ... proximity' is itself an occurrence in and of place - it is an occurrence that needs no special such 'place' but, is rather the happening of place as such.' (Malpas, 2007, p. 307)

What becomes visible here is that such a review of Heideggerian aspects of Embodiment cannot lead directly to actionable guides to the design of Embodied HCI, but help one to see things from a new perspective.

Substantiality

Substantiality, after Heidegger, is characterized by Malpas as '(...) the usual conception as tied to material extendedness alone' (Malpas, 2007, p. 260). He also adds the potential of manipulability: '(...) the treatment of the natural world as a source of 'raw material' for human production and as open to human manipulation and control (...)' (Malpas, 2007, p. 281).

If transferred to HCI, the concept of manipulability would be considered the input. As for the corresponding output, Malpas notes for the perceivable presence: 'Heidegger, of course, looks especially to (…) what Aristotle called 'ousia', the really real, the primary being, 'substance'. Heidegger claimed that one of the great breakthroughs in his own thinking was to realize that this Greek understanding of being was based in the prioritization of a certain mode of temporality, namely the present, and so understood the being of things in terms of the 'presence' or 'presencing' of things in the present - in terms of the way they 'stand fast' here and now.' (Malpas, 2007, p. 61)

From Theory to Practice

The previously reviewed concepts are, by their very nature, abstract and purely theoretical. The preceding part of this work has reviewed these concepts, as they may help us to analyze the paradigms underlying current and past HCI through a new analytical lens.

The following part of this paper will do so: It is a historical analysis of HCI practice, analyzing the involved characteristics of embodiment, immediacy, and thinghood.

The last part of this work is an investigation of how we could interact with digital contents in the future in a more immediate way. As the means of investigation, we propose a Research through Design approach. This seems worthwhile, as the target field is dominated by interplay of theory, bodies and artefacts. Producing concrete artefacts that represent abstract theories may prove to be a suitable means to learn how human-computer interaction could be designed in the future, and if immediacy is a valuable model for this endeavour.

Embodiment, Immediacy and Thinghood in HCI Practice

In this section, we will review the practice of HCI in different developmental stages of the past decades: Command-Line Interfaces, Graphical User Interfaces, and Tangible User Interfaces. Each stage will be analyzed for its characteristics of

- *Embodiment* (Dourish, 2001),
- *Immediacy* (Bolter & Grusin, 2000), and
- *Thinghood* (Heidegger, 1927).

Command-Line Interfaces

In Command-Line Interfaces (CLIs), digital content is interacted with through textually articulated commands and responses. The primary input is the keyboard; the primary output is a text-based display.

Embodiment in Command-Line Interfaces

Working with computers that utilize CLIs is a physical activity. Content is manipulated through physical buttons, and work occurs often in social context. It may be argued that digital content is not physically represented, but that does not affect the physicality of the keyboard. This media, the keyboard, is even *ready-to-hand* after having used it for a sufficient amount of time: Command-Line Interfaces draw on embodied skills.

Immediacy in Command-Line Interfaces

Digital content in CLIs is displayed on a screen, in written, textual form. This style of output matches the manipulatory input: *Written* commands, regardless of the type of digital content at hand. For instance, a car traffic simulation would have to be programmed into the system textually, and result in number results, rather than rich graphical results (e.g. a map, or a graphic chart). Text is the mediator, which may be useful in some cases, but inappropriate and cumbersome in others.

Thinghood in Command-Line Interfaces

Most digital content in CLIs is displayed *virtually* and *mediatedly.* They may retain their substantiality, extendedness and proximity, but none of these properties is directly available to users in any interactions. Users have to interpret the verbal descriptions: CLIs thereby operate on the level of *described* things.

Graphical User Interfaces

In Graphical User Interfaces (GUIs), digital content is accessed through graphical and textual items on different representational levels. It is manipulated through mouse and keyboard interactions.

Embodiment in Graphical User Interfaces

Interacting with GUIs is predominantly shaped through interacting through a mouse. A keyboard may be involved, too, but for clarity reasons, we will focus on the mouse here. A mouse inherently picks up on embodied skills: Spatiality and pressure (as in clicking). Also, interaction often occurs in social contexts – people have learned to cope with the fact that a mouse is a single-user device. GUI Interaction is embodied, and can, similar to the CLI, become ready-to-hand just through sufficient practice.

Immediacy in Graphical User Interfaces

Digital contents are represented graphically in GUIs. This leaves more room for representational styles than the CLI does: Things can be represented iconically, symbolically, or indexically (Peirce, Houser, & Kloesel, 1998). Interpreting these signs can be much easier than interpreting textual representations, and so can be manipulating them: Changing the size of a digital object can be achieved through pointing to its edge with the cursor, mediated through the mouse, grasping it, mediated through the mouse button, and altering it through a respective movement. The interaction is still mediated, but less mediated than in the CLI: Representation and Manipulation occur in the same space, virtual graphics, even though through tools (like mice) that make this space accessible for users.

Thinghood in Graphical User Interfaces

Digital content in GUIs is displayed *virtually* on a screen, but can be displayed in more *immediate* forms: Images. Thereby, they gain thinghood on the levels of *extendedness*, *substantiality* and *proximity* – represented in virtual space, on a screen. GUIs operate on the level of *depicted* things.

Tangible User Interfaces

In Tangible User Interfaces (TUIs), digital content is physically manifest, and thereby physically manipulated and perceived.

Embodiment in Tangible User Interfaces

TUIs draw on embodied skills: They represent digital contents physically, and often also react to physical input. This display and manipulation can occur socially accessible in the real world. It

should be noted that almost every user interface hardware, including mouse and keyboard, is necessarily tangible, as it needs to allow manual interaction.

Immediacy in Tangible User Interfaces

TUIs have the potential to map input and output closely together, which makes interacting with their digital inner a seemingly analogue activity. Here, the term *immediacy* seems to describe particularly well what occurs to the user: Physical representations can be manipulated physically, directly, leading to changes in the digital layer.

Thinghood in Tangible User Interfaces

In his paper 'Tangible Bits' (Ishii & Ullmer, 1997), which is considered the starting point of TUIs, Ishii draws on Heidegger to explain the possible benefits of the TUI paradigm. Indeed, the characteristics of things proposed by Heidegger can be observed in many TUIs: physical *extendedness*, physical *substantiality*, and physical *proximity*.

TUIs operate on the level of *physical* things.

Summary

Comparing the historical phases of HCI, from CLIs to GUIs and TUIs, the level of embodiment has not changed: All human-computer interaction is both physical, as computers necessarily are, and social, as humans always have been.

Immediacy, however, seems to have increased. The styles of textual, graphical and physical representation bring digital contents more closely to us. They also foster the coincidence of input and output (Ishii & Ullmer, 1997), which makes interacting with them a seemingly *direct* experience.

Thinghood also provides an interesting view on things: All interactions operate, necessarily, on some level of thinghood. The level of CLIs is the level of *de-scribed* things, the level for GUIs is the level of *de-picted* things, and for TUIs, it is the level of *physical* things. The prefix 'de-' suggests that the *-picting* and *–scibing* originate in something: The object itself. It may be well possible that the physical representation of the TUI is more direct, as it is by no means 'de-materialized', but rather the contrary, *material*.

Making Digital Content Graspable

Heideggerian thinghood is increasingly prominent in Tangible User Interfaces. It might be interesting to see if the Heideggerian concepts can help us to make digital contents more ready-to-hand.

To investigate this matter, we present three projects from our research that have taken different steps to make immaterial digital content, as a first step towards readiness-to-hand, present-at-hand.

Substantiality: Weight-Shifting Mobiles

Fig. 1: The Weight-Shifting Mobiles prototype.

In this project, weight is considered a physical pendant of *substantiality*. The mobile phone developed here is able to shift its centre of gravity by moving an iron mass on its inside.

Users appreciated the fact that they were now able to 'feel' the digital content. They were able to estimate the weight's position on the device's inside at a considerable niveau of accuracy, and enjoyed the subtleness of the approach (Hemmert, Hamann, Löwe, Zeipelt, & Joost, 2010b).

Extendedness: Shape-Changing Mobiles

Fig. 2: The Shape-Changing Mobiles prototype.

In this project, a deformation of a mobile phone's case is investigated as for its utility as a display for digital contents. In this example, immaterial digital entities are represented through physical volume: *extendedness*. For instance, digital items that are off the screen of the mobile phone can be displayed through a thickening of its casing toward the respective edge.

Users intuitively understood the mapping, and appreciated the leveraging of their hands sensitivity, rather than being visually overloaded even more (as they often experienced it in GUIs) (Hemmert, Hamann, Löwe, Zeipelt, & Joost, 2010a).

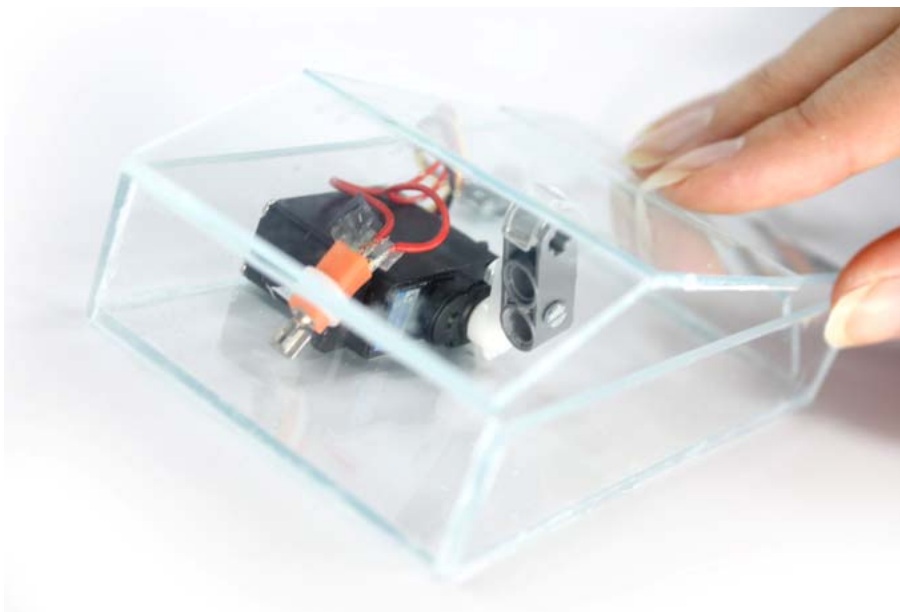### Proximity: Ambient Life

Fig. 3: The Ambient Life prototype.

This project operates on another level. It proposes a metaphor for digital content: life. The project investigates signs of life like breath and pulse as a means of display for the inner state of a mobile phone. For instance, the phone can be 'calm' when no calls have been missed, no new text messages have arrived, and the battery level is sufficient. It switches to 'excited' mode as soon as

it needs the user's attention. This metaphor draws on our perception of living beings, and also exaggerates the already close relationship between user and mobile phone: It explores the role of *proximity*.

Users typically fell into one of two groups, with the first group being attracted by the 'cuteness' of the system, and the second group being disgusted – an interesting circumstance, as the simulation caused reactions that would normally occur as reactions to animals, and not as reactions to phones (Hemmert, 2008).

Conclusion

The three projects presented here investigate the three characteristics of *thinghood* proposed by Heidegger; Users generally appreciated the directness of these approaches. However, such physical displays seem to be generally limited in their communicative bandwidth: They are often only one- or two-dimensional, being able to display only a small number of data points. The richness of these displays does not lie in the number of things they can display, but in the quality of the few things that can be displayed.

The means of this investigation, *research through design*, have shown their strength in order to make abstract concepts manifest, experiential and situated in both the researchers' and the users' life-world.

We conclude that *thinghood* is a fruitful source of *inspiration for the design* of *immediate* interaction. A physical body in a social world is our medium to interact with computers, which is the reason why HCI is, as it always has been, embodied.

References

Bolter, J., & Grusin, R. (2000). Remediation: Understanding New Media: The MIT Press.

Dourish, P. (2001). Where the Action Is: The Foundations of Embodied Interaction: {The MIT Press}.

Heidegger, M. (1927). Sein Und Zeit.

Heidegger, M. (1996). Being and Time: Blackwell Publishers.

Hemmert, F. (2008). Ambient Life: Permanent Tactile Life-like Actuation as a Status Display in Mobile Phones. Paper presented at the UIST '08: Adjunct Proceedings of the 21st annual ACM symposium on User Interface Software and Technology (Monterey, California, USA, October 20 - 22, 2008).

Hemmert, F., Hamann, S., Löwe, M., Zeipelt, J., & Joost, G. (2010a, April 10-15). Shape-Changing Mobiles: Tapering in Two-Dimensional Deformational Displays in Mobile Phones. Paper presented at the CHI '10: Extended Abstracts on Human Factors in Computing Systems, Atlanta, Georgia, USA.

Hemmert, F., Hamann, S., Löwe, M., Zeipelt, J., & Joost, G. (2010b, April 10-15). Weight-Shifting Mobiles: Two-Dimensional Gravitational Displays in Mobile Phones. Paper presented at the CHI '10: Extended Abstracts on Human Factors in Computing Systems, Atlanta, Georgia, USA.

Ishii, H., & Ullmer, B. (1997). Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms. Paper presented at the CHI.

Jacob, R., Girouard, A., Hirshfield, L., Horn, M., Shaer, O., Solovey, E., et al. (2008). Reality-based interaction: a framework for post-WIMP interfaces. Paper presented at the CHI '08: Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, Florence, Italy.

Malpas, J. (2007). Heidegger's Topology: Being, Place, World: The MIT Press.

Peirce, C., Houser, N., & Kloesel, C. (1998). The Essential Peirce: Selected Philosophical Writings, 1893-1913: Indiana University Press.

Seow, S., Wixon, D., MacKenzie, S., Jacucci, G., Morrison, A., & Wilson, A. (2009). Multitouch and surface computing. Paper presented at the CHI EA '09: Proceedings of the 27th international conference extended abstracts on Human factors in computing systems, Boston, MA, USA.