An Agenda for Designing Natural Interaction in a Museum Context

Lund, Morten

Published in:
The Transformative Museum

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

An Agenda for Designing Natural Interaction in a Museum Context

Morten Lund, Ph.D. Fellow
Department of Communication & Psychology
Aalborg University
Teglgards Plads 1
9000 Aalborg, Danmark
mlund@hum.aau.dk

"Everything that's already in the world when you're born is just normal; anything that gets invented between then and before you turn thirty is incredibly exciting and creative and with any luck you can make a career out of it; anything that gets invented after you're thirty is against the natural order of things and the beginning of the end of civilisation as we know it, until it's been around for about ten years, when it gradually turns out to be alright really."
Douglas Adams, 1999

Abstract
This paper introduces an agenda for designing "Natural Interaction" that originate in investigations into new digital technologies, embodiment, interaction-design and natural user interfaces. The agenda introduces four themes that seek to inform professionals working with communication and productivity about how current digital technologies could integrate and support a "Natual Interaction" approach to communication-, interaction-, and information-design. The themes are qualified through a case at Bangbo Museum in Frederikshavn, Denmark.

Introduction
One of the seminal texts in defining the discourses of HCI in the past 25 years is "*Understanding Computers and Cognition*" by Terry Winograd and Fernando Flores. The first chapters sketch how computers are being integrated into human activities and how the previously dominant "*rationalistic tradition*" is not the only one relevant to adress the questions occurring "*when we recognize that in designing tools we are designing ways of being*" [Winograd 1986]. The understandings advocated by Winograd & Flores have largely been integrated into current practice and education around design of computer systems and interaction. However, computing has also grown more complex, distributed and embedded than foreseeable in 1986. The current manifestations and potentials of digital technology indicate that it is time to revisit the "humanising computing" agenda of Winograd and Flores.

Computing and digital technologies are no longer a novelty, but an integrated and fundamental part of most peoples lives and as the Douglas Adams quote indicate, then the generations born around 1986, have lived all their life with digital technologies and therefore take the presence and abilities of digital technologies for granted. Actually one could question if talking about *digital* technologies is relevant anymore.

My favourite anecdote to illustrate the coming of digital natives is about a toddler just capable of speaking, who had taken over the familiy iPad and gotten used to browse and manipulate images through gestures. One day a printed photograph was on a table and the toddler started gesturing on the image, but no reactions from the image – it maintained size, position, orientation, etc. So after a few attempts the toddler exclaimed her judgement over

the printed photograph: "*Broken!*" [Kelly 2011]. The age, use of language and previous iPad only experience with photographs indicates that the little girl did indeed think the printed photograph was broken as it did not exercise any of the expected usual capabilities. She saw the interactive and dynamic capabilites of the digital image as inherent properties of any image; the lack of these clearly being erroneous.

The four themes of this text represent an attempt at articulating an up to date agenda entitled "Natural Interaction". Natural Interaction is build on solutions that exploit the powers of digital technologies and support human presence, perception and cognition. See [Jacob 2008]. The agenda looks like this: Theme 1 address concrete technological possibilities. Theme 2 summarises a hermeneutic phenomenologically understandig of human presence and perception. Theme 3 address information as a design-material. Theme 4 address the consequences of Themes 1-3.

The Case

In 2010 two graduate students from ExperienceDesign at Aalborg University designed, implemented (and tested) a novel exhibition-component at the Bunker museum at Bangsbo Museum in Frederikshavn, Denmark. The component aims at communicating about the WW II area and in particular Bangsbo Fort and the danish resistance. Visitors are given an ID card which identifies them when interacting with or in proximity to elements of the exhibition. The component is designed as a game, in the sense that participants at the end of the event will be provided a score. Visitors must work in pairs. Initially they are provided information about the time of WWII in Denmark and the danish resistance. This is done while situated in the bunker-environment and a screen-projection of an actor playing the part of a danish resistance leader will then ask the participants to enter another bunker to solve tasks and collect information in a german bunker. In the german bunker there are artifacts and lifesize german soldier replicas and the bunker is equipped with various sensors that track and monitor the actions of the participants In the german bunker there are artifacts and responsive lifesize german soldier replicas and the bunker is equipped with various sensors that track and monitor the actions of the participants. The collected information must be reported back to the resistance leader and together with information collected about their conduct in the german bunker, the score is calculated. [Maul 2010]. The thesis was awarded a 12, still a part of Bangbo Fort and very popular.

Museums in transition (too)

Museums are very human – or they should be. They tell us about ourselves and allow us to explore who we are, the world we live in, how it became this way and maybe where we're heading. Therefore the activities and processes of communication, education, learning, exploration, etc. are at the heart of museumstrategies and –objectives [Muslov 2006].

Museumvisitors should experience a communicative continuity when moving from the outside world to the realm of a museum [Krippendorff 1989]. The Natural Interaction agenda reach beyond the context of museums and provide anchoring in the tendencies, potentials and understandings of contemporary computing. But due to their communicative objectives, then museums have the opportunity to build upon, extend and explore the tendencies, potentials and understandings of digital technology. As seen at Bangsbo Fort where some inspiration is found in computer games and the solution contributes to the understanding of what is possible when integrating digital technology.

The agenda is relevant to museums of all types and sizes because the considerations originate in interaction and interface design, which is basically about communication. Interactivity has been defined as various communicative modalities of power over content - does the consumer and/or producer control the content [Jensen 1997], [Preece 2007]. Museums communication at all levels; from the very subtle interaction with some element in the exhibition, to the overall purpose of the exhibition. And ideally these pieces of communication connect meaningfully while controlled by the visitors.

A challenge to the professional museum-communicator is therefore to properly understand digital technology before implementation. Because, as with any technology, then it affects the possibilities of designing and the potential understandings of the visitors. Donald Norman developed the theory of Designers conceptual model, System image and Users conceptual model. He explains how the designer expects the user to have or obtain the same understanding (the same model) as the designer put into her model, but in reality, then the user only sees the system image and shapes her conceptual model upon an interpretation of this [Norman 2002]. The theory very simply explains why the task of designing is a sensitive undertaking that require the designer to understand the components that constitutes a design and thus manifest the system image to the user.

Theme 1: Pervasive presence of information collection, information access and information processing

This theme is rooted in the perspective on computing known as ubiquous or pervasive computing originally described by Mark Weiser of Xerox PARK [Weiser 1991]. Weiser focus on the consequences of the increasing (visible and invisible) presence of enabling technologies. The vision of ubiquous computing might be one of the most successful predictions of how computing would evolve, but what is concretely the technological status and tendencies?

Digital, massproducable and economically accessible input- and output technologies have enabled a previously unaccessible level of detail in the design of digital interaction (eg. sensors). And there is a widespread presence of technologies that link information, people and places. The historian George Dyson, in a recent interview, estimated that the "*digital universe was expanding at the rate of 5 trillion bits per second*" [Kelly 2012]. How does that happen ?

The granularity for collecting, accessing and processing information in a digital format has increased dramatically. By granularity, I refer to how many technologies are digital (dependent on a digital chip to function) and I refer to the number and variety of activities they are part of. The terms collecting, accessing and processing should be understood in the broadest possible sense (including exchanging information) and are not limited to activites controlled by humans, but also those controlled by the devices themselves.

Soem examples: Image capture and presentation is digital and even used as an input technology (eg. QR codes). Audio playback and capture is digital and voicecontrol has seen commercial success. Touch is common for screen and other surface based input. Haptic technology tactile feedback is close to commercial introduction. Location technologies have created new types of communication through mashups and new activities like geocashing. Connectivity via mobile, WiFi and various types of close range communication (eg. keycards) are taken for granted. Location and connectivity creates mobility of data – anything, anytime, anywhere; and possibly anyhow because of cloud-computing making access only dependent on id and password. The Nintendo Wii introduced gesture-based interaction, but was

surpassed by Microsoft Kinect that require no controller to recieve input from body-movements and gestures. Various interaction modalities are enabled by a multitude of sensors: accellerometers, gyros, light, sound and proximity detectors, compass, thermometer, fingerprint, retina and facial expression recognition. And other sensors monitor physiological data like heartrate and galvanic skin resistance. This recital only adress hardware, while much digital technology actually happens in software. Email, Twitter, Facebook, and Youtube only have a digital existience and so have the hundredthousands of mobile apps.

Humans and animals used to be the only entities capable of collecting, accessing and processing information, but digital technologies now present the same capabilities. The physical world is getting digitised and we consume the world in this format. The granularity of collection, access and processing has reached a stage where digital seems to have become or is in the process of becoming the primary modus for mediated perception and interaction with the world. Eg. then the sensitivity of a smartphone accelerometer makes it possible to control a remotely operated helicopter and doctors perform surgery via camera and other digitally contolled tools. The amount of information collected and exhanged digitally enable the performance of these actions because they allow the operator to focus on the task and not the tool. The granularity of information available creates the possibility of a very close connectedness to the objective of the action and not the tools used to perform the action. Digital technologies makes the world perceptible to humans on human terms. Digital technologies turn information into a material and the bitbased nature of digital extends the possibilities of weaving a fabric from many and different sources. Bits are not, like atoms limited to a certain context, but enable new constellations and relations, not only among bits. Bits also allow atom-based artifacts to be enriched, altered or affected by information taken from other atom-based artifacts or contexts [Negroponte 1995] and [Ishii 1997].

The Bangsbo case could not be realised without the digital nature of the technology used. Wireless connected id cards that makes each visitor unique and likewise the information reqistered about movements and interactions. Various modalities for interacting with the resistance leader and objets and soldier replicas in the german bunker. And most of it happening without the visitors actively interacting with the technology. The technology is discreet and allow each visitor to have unique experience and get the feeling of being immersed into a different reality, but still based on the same perceptive and cognitive abilities used in the outside world. The game indeed does utilise the ability of pervasive presence of information collection, access and processing.

Theme 2: The body as interaction device

This theme looks at how we understand ourselves, our presence in the world and thus the requirements for the tools we design. The outset is the understanding of human presence in the world as physical ”body-first” entities and not cartesian mind-based entities. The world is present and available before we perceive it [Gibson 1977] and we perceive it with our senses first and our intellect secondly [Dourish 2001].

This becomes relevant to the design of interaction as digital artifacts need not be manipulated via a proxy (eg. mouse and pointer), but could offer properties and affordances that adress perception and reaction based on a wider set of senses and stimuli. Tools and artifacts should be ready-to-hand in the Heideggerian sense [Dourish 2001], [Winograd 1986]. Focus should be on the task to perform, not operation of the tool. When sneaking about in the german bunker then attention should be at moving quietly and swift, not to wake the

sleeping guard. Attention should not be at sweeping your ID-card to register presence in the room. I'm on a quest, not in a museum!

[Dourish 2001] is focused on embodiment which he views as the "*unifying principle for tangible and social computing*". He presents a definition of embodiment and embodied interaction that builds on a hermenutic phenomenological understanding of human activities and perception. The definition is build on the concepts of philosophers Husserl, Heidegger and Merleau-Ponty, sociologist Alfred Schutz, cognitive psychologist J.J. Gibson, Michael Polanyi and others. Dourish defines embodiment as: "*the property of our engagement with the world that allows us to make it meaningful*" and he goes on teo define embodied interaction as: "*the creation, manipulation, and sharing of meaning through engaged interaction with artifacts*". These definitions reflect very well up against the perspectives presented by theme 1 and 3. The definitions have an implicit focus on information as the perception and interperation of information is also the source of meaning.

[Jacob 2008] presents the idea of Reality-Based Interaction based on a framework for describing human relation to the world. The framework introduces a very operationally oriented understanding of embodiment: Naïve Physics – human common sense knowledge of the world; Body Awareness & Skills – human attention on bodily presence and skills for controlling and coordinating the body; Environment Awareness & Skills – human sense of the surroundings and abilites to negotiate, manipulate and navigate this environment; Social Awareness & Skills – human attention to other people and skills for interacting with them.

The Bangsbo case does quite obviously only work because it is based on embodiment, but [Christensen 2007] is more interesting for this theme as the study compares three quite different attractions to computergames and provide findings on the role of bodily presence and interaction across three attractions. One attraction allow visitors to follow walkways in exotic environments with free-rangeing animals. Another attraction is a classic art-museum with pieces exhibited on walls and piedestals and explanatory plaques. The third attraction is a large shopping-mall and store of stable goods. Both museums offer a museum-shop. The study found that the zoo, the shopping-mall and the museum-shops have integration of bodily interaction in common – and involves the components presented by the Reality-Based Interaction framework. The art-museum uses the body to move the mind around. This is not wrong from the perspective of traditional museum-communication, but it does not support how humans relate to the world and how the world is experienced. It could be argued that a traditional art-museum is embodied as you move around and use your eyes to percieve the rooms and objects. But the experience is primarily based on presupposed knowlege of the aesthetic, historic, cultural, etc. context in which the pieces should be understood. [Christensen 2007] compare the art-museum to an encyclopedia by. It's like walking in a book. This is fine, but the engaged audience is limited to those that accept the premises and if compared to the potentials of combining technological capabilities and the understanding of embodiment and considering how the Bangsbo case manages to simultanously engage, involve and educate the visitors (without compromising the historical integrity), then the Natural Interaction agenda does indeed allow and encourage re-invention of communication at the classic art-museum. This however, may challenge the view of what is art and the line between entertainment and communication.

Theme 3: Re-understanding information in terms of presentation, representation, navigation, search & findability

Our relation and understanding of information is shaped by the presence we give information. As an example, then mouse-based interaction (direct manpulation) and the graphic desktop metaphor have provided the image of file-containers as folders, actions and processes as taking place in closed areas (called windows) and tools as text-based lists or images (called icons). The desktop metaphor is fine – eg. from a standpoint of familiarity, efficiency and productivity, but if done differently then other aspects of information and the relations hereof would occur. A different metaphor would have yielded other modes of presentation, other representations, etc. But the desktop metaphor was the one selected at Xerox PARK and later duplicated by the Macintosh and Microsoft operating systems. Basically, then metaphors like the computer desktop are abstract skeuomorphism. Skeuomorphism has some advantages, but it also sustain the properties of the referenced object and influence expectations for the interaction. I believe we need to revisit the digital material and understand digital information and interaction on the terms of its binary nature. What characterises digital ?

[Wigor 2011] call attention to the distinct opportunity of digital interaction that they call *"Super realism*". The digital design may mimick some trait of reality, but it may also add non-real capabilites; capabilites that build upon and extend the mimicked model. Eg. a list of objects on a touch-screen is scrolled by a flick gesture, but the list will move faster and further than if the same flicking power was applied to a real world rolodex. The fast scrolling is perfectly acceptable and comprehensible, but has capabilities far beyond the original real world model. So there is a skeuomorphism in the reference to the rolodex, but the digital nature of the design allow an extension and re-invention, that contains the positive sides of each parent. Arthur C. Clake said: *"Any sufficiently advanced technology is indistinguishable from magic*" I would paraphrase him and say: *"Any sufficiently advanced technology is indistinguishable from reality*".

When designing with the digital material then we should consider how it is *presented*: the order and structure; how it is *re-presented*: the shapes, colours, sounds, movements, tactility, etc.; the *navigation*: the relations that enable travel and support of technical means of interaction (touch, audio, spacial orientation, haptics, etc.); *searchability*: supporting different search strategies [Morville 2010] and *findability*: how to signify the information, so that it can be identified and found if relevant and required [Morville 2005].

This theme connect to considerations about why people visit a museum and how they use the museum. What is interesting and why is it interesting? How is something made interesting? What information should be accessible and in which format? I supervised a group of students analysing the new "Expedition Northsee" exhibition at Nordsøen Oceanarium, Denmark. The students found that few visitors actually got involved into the intended experience, but had a good experience anyhow. The exhibition design is a failure on the conceptual level, but from the visitors perspective it is successful. Among other things because both adults and children were allowed to browse and skip around, they needed not follow the experience design. The Bangsbo case is similar as it use digital technology to create an environment, but no structure. It also supports the possibility that there might be as many answers as there are visitors, but the digital material allow a dynamic design with many entry-points to the information in the game. Designing for search, findability and navigation is as relevant to the Bangsbo case as it is to the art-museum. Presentation and re-presentation of information should be dynamic and reflect who, why, and where. Information is a material, not a goal. Hypertext, mashups and

super realism will enable novel modes of presentation, re-presentation, navigation, findability and search.

Theme 4: Transgression of realities from virtual to real and real to virtual

This theme is both a consequence of the three other themes and a theme in itself.

As a theme in itself, then it should be seen as an onthological and epistemological approach that questions the concept of real. Digital is often in science and popular debate equated with virtual and seen as the opposite of physically real. Real as in ”occurring in the physical multidimensional world of atoms”. Virtual is usually conceptualised as artificial or ”not really existing”. But many phenomenons only exist virtually – eg. digital images, Facebook and mobile text-messages – and this (socalled) virtual presence is their real and original instantiation. Does the concept of virtual prevent a proper understanding of these phenomenons? I think not. Their users treat them on the terms of their actual existence and manifestation – as digital phenomenons that are dynamic, hyperlinked, superreal and weaved together in a fabric of many bitbased sources. Nobody prints a Facebook update – to make it more real or the contents more reliable, but they happily click, forward, comment and ”like” updates, links, images, videos, etc. Facebook is as real as a daguerreotype – it’s just another technology - another format of information. They even share the feature of handheld mobility: a daguerreotype is a glassplate and so is Facebook when viewed on a touchscreened smartphone or tablet. In some respect, then Facebook is even more real than a daguerreotype, because the latter is actually a copy of reality. A unique copy of those few seconds of reality. Facebook is dynamic and reflects the actions of the participants. It is always new. Facebook is real-time reality, but a fairly new material for reality.

So, it sounds as if phenomenons that originate in the digital realm are percived as real and treated as real, but previously atom-based technologies, that have turned digital or are in the process are perceived as virtual – or atleast as not rightly real. Unless of course you’re a toddler who has never seen a printed photograph, then the printed photograph is broken. in order to properly understand and utilise the potentials of the digital material then an onthological and epistemological perspective that understand digital phenomenons as real must be attained.

Seeing this theme as a consequence of the three other themes, constitute a movement that will consequently create a transgression between real and virtual which will eventually turn the line between real and virtual into an invisible two-way contiuum. And by defining *transgression* as an individual theme I hope to push this movement, whichI see as inevitable. It is a movement that is already happening and very eloquently described by [Pine 2011], who presents a model called the *Multiverse*. The model is meant to inspire new thinking about how digital and physical realities relate to each other and what are the posssibilites of these realities. The model is 3 dimensional and consist of three axises: Matter (Atoms) vs. No-Matter (Bits); Space (Real) vs. No-Space (Virtual) and Time (Actual) vs. No-Time (Autonomous). These axises creates a cube of 8 different –verses. Each with different properties depending on the defining axises. This model brilliantly shows how the transgression is possible and already happening. And it illustrates the role of digital technology and therefore also why the agenda must now focus on understanding this material that has been rapidly maturing for 20 years.

The Bangsbo case is a transgression. The resistance leader is bits, but the task he orders can only be solved among atoms in real time. The actants act as they always do, but monitored

and their actions collected, processed and mashed up with the result of their quest. The bunkers, guard replicas and objects found, seen and touched are atoms of historical reference and used to concretise and immerse the visitors into a story introduced via digital media. In the multiverse model of [Pine 2011], the Bangsbo solution would qualify as ”Warped reality” as space and matter are significant, wheras time is that of the past. Clever use of digital technologies creates a new reality that warp the participants back to the danish resistance of WWII. Those that created the Bangsbo solution were not hesitant about the digital material and focused on the idea, not the technology.

Conclusion

The four themes of Natural Interaction are circular in the sense that one would not exist without the other. They describe an approach to understand the consequences of digital in an equally philosophical and concrete sense. Pursueing the agenda will reveal a spiral: the more we transgress realities the closer we get to creating designs that support embodiment. And the closer we get to supporting embodiment, the more integrated must our understanding and handling of information have become.

The crux of the agenda is theme 3. Theme 3 defines understanding of digital as a design-material. This understanding is based on an acceptance of digital phenomenons as just as real as atom-based phenomenons (theme 4); and it is based on a final break with the split between mind and body established in the late renaissance (theme 2); and it is based on the binary nature of digital technologies that enable constellations not previously possible (theme 1).

But digital technology begins and ends in the physical universe. Atoms are captured and converted to bits, processed and presented through modalities that allow consumption by atom-oriented humans. The human approach to the world is rooted in our physical presence and Natural Interation is the next agenda for computing; and this will help us better tell our stories.

References

[Adams 1999] Adams, Douglas 1999. How to Stop Worrying and Learn to Love the Internet. The Sunday Times, August 29th 1999. www.douglasadams.com/dna/19990901-00-a.html

[Christensen 2007] Christensen, Lars Holmgaard; Gram, Malene and Jensen, Thessa 2007. *Hvis din attraktion var et computerspil - Iscenesættelse af oplevelsesattraktioner*. In Forbrugssituationer. Perspektiver på oplevelsesøkonomi. Jantzen, Christian and Rasmussen, Tove Arendt (ed.) Aalborg Universitetsforlag, p. 125-147.

[Dourish 2001] Dourish, Paul 2001. *Where the Action is - The Foundations of Embodied Interaction*. MIT Press.

[Gibson 1986] Gibson, James j. 1986. *The Ecological Approach to Visual Perception*. Lawrence Earlbaum Associates. Originally published 1979.

[Ishii 1997] Ishii, Hiroshi; Ullmer, Brygg 1997. *Tangible Bits - Towards Seamless Interfaces between People Bits and Atoms*. In Proceedings of SigCHI Conferrence 1997.

[Jacob 2008] Jacob, Robert J.K.; Girouard, Audrey; Hirshfield, Leanne M.; Horn, Michael S.; Shaer, Orit; Solovey, Erin Treacy and Zigelbaum, Jamie 2008. *Reality-Based Interaction: A Framework for Post-WIMP Interfaces* in proceedigns of CHI 2008 conference.

[Jensen 1997] Jensen, Jens 1997. *Interaktivitet – på sporet af eet nyt begreb i medie- og kommunikationsvidenskaberne*. in Mediekultur nr. 26.

[Kelly 2011] Kelly, Kevin 2011. *Born Digital*. Blogpost at www.kk.org/thetechnium/archives/2011/04/born_digital.php

[Kelly 2012] Kelly, Kevin 2012. *Q&A: Hacker Historian George Dyson Sits Down With Wired's Kevin Kelly*. In Wired Magazine March 2012. www.wired.com/magazine/2012/02/ff_dysonqa/all/1

[Maul 2010] Maul, Kristian and Michelsen, Mark 2010. *Bunker 43 – Så kan de lære det! – Om læring og museumsformidling der virker*. Thesis from Experience Design, Aalborg University.

[Morville 2005] Morville, Peter 2005. *Ambient Findability*. O'Reilley Media.

[Morville 2011] Morville, Peter and Callender, Jeffrey. Search Patterns. O'Reilley Media.

[Muslov 2006] Museumsloven af 2006. www.retsinformation.dk/Forms/R0710.aspx?id=12017 (visited 21.03.2012).

[Negroponte 1995] Negroponte, Nicholas 1995. *Being Digital*. Alfred A. Knopf Inc.

[Norman 2002] Norman, Donald 2002. *The Design of Everyday Things*. New York : Basic Books

[Pine 2011] Pine II, Joseph B. and Korn, Kim C. 2011. *Infinite Possibility – Creating Costumer Value on the Digital Frontier*. Barrett-Koehler Publishing.

[Preece 2007] Preece, Jenny; Sharp, Helen and Rogers, Yvonne 2007. *Interaction Design – Beyond Human-Computer Interaction*. 2nd edition. John Wiley & Sons Ltd.

[Weiser 1991] Weiser Mark 1991. *The Computer for the 21st Century*. in Scientific American special Issue on Communications, Computers, and Network.

[Wigor 2011] Wigor, Daniel and Wixon, Dennis 2011. *Brave NUI World – Designing Natural User Interfaces for Touch and Gesture*. Morgan Kaufmann

[Winograd 1986] Winograd, Terry and Flores, Fernando 1986. *Understanding Computers and Cognition*. Ablex Publishing Corporation, 4th printing 1988.