

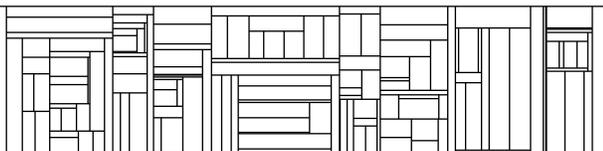
**Aesthetic Approaches to
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Index

Bertelsen, O. W.	Tertiary Artefactness	1
Bødker, M.	Position Paper for the Aesthetic HCI Workshop	5
Christensen, M. S.	Introducing Excitability	10
Hallnäs, L.	Interaction Design Aesthetics – A Pos. Paper	14
Hammel, M.	The Aesthetics of Use	17
Jacucci, G.	An Anthropological Notion of Performance for the Design of Physical interfaces	20
Knight, J. & Pandir	An Experimental Aesthetics Approach to Evaluating Websites	24
Laarni, J	Aesthetic and Emotional Evaluations of Computer Interfaces	28
Petersen, M. G.	Aesthetics of Interaction – a Pragmatist Perspective	31
Pold, S.	Material Matters – What can HCI Learn from Aesthetics?	33
Ribero & Hammond	What is Aesthetics anyway? Investigating the use of the Design Principles	37
Tollmar, K.	Searching for the Aesthetics of Everyday Technology	41

Transparency by Tertiary Artefactness

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In this paper I discuss how human-computer interaction can advance if redefined as an aesthetic discipline. More specifically, how this redefinition can be grounded in Wartofsky's concept of tertiary artefacts. The potential of this concept is that it places experience and culture as first order aspects to be integrated with the traditional foci on cognition and work arrangement design.

I

The concept of transparency and the current debate about it illustrates a dilemma in HCI. As pointed out by recent critics (e.g. Bolter & Gromala 2003), the concept has probably been given a too literal or naive meaning by parts of the HCI community from whom the critics adopt a notion of transparency as just meaning that the user does not notice the interface. I partly agree with this criticism, but at the same time I think it is important to maintain that transparency is an indispensable feature of any computer-based artefact in the sense that the computer *per se* should not obscure the user's view. The problem, however, is that the critics seem to build a dichotomy between interfaces that are statically transparent and another kind of interfaces that are reflective, artistic or somehow else interesting. This is, I will argue, a false dichotomy because exactly the dynamics between computer applications as transparently mediating interaction with the object of work, and computer applications as being the object in situations of learning to use it, or in situations where conditions for its use change has been treated in HCI for the last 20 years. Thus, if understood as a feature of the dialectical relation between users, tools, and objects in a cooperative work arrangement the concept of transparency should still be a central concern for HCI.

II

Two main tendencies are seen in HCI. In the first generation, focus was on the perception and cognition of individual users in isolated interplay with the user interface; the aim was to minimize cognitive load on the user by optimizing the interface to best fit the general human. In the second generation, it was realized that users couldn't be understood in isolation and that HCI therefore should take the whole work arrangement into account; the skilled workers tool became the ideal. In both periods transparency in some form has been the unspoken ideal.

An important background for the evolvement of the context-oriented perspective in the second generation was politically engaged young researchers' experience developing

new technology for, e.g. the graphics industry, together with the workers. They saw that many problems with new technology came about because the competencies of the workers were neglected. On this background the tool perspective evolved, emphasizing that, the user was not an attachment to a computer-based system but that computer-based systems should be transparent tools mediating the user's purposeful, skilled action on an object of work. It was realized that the use aspects of a computer-based system was constituted in the situation of use, and therefore could not be deduced from the computer-based system as a thing in isolation. Thus, development in use became a key issue as it was observed that computer-based systems were most often used in unanticipated ways.

Today, HCI seems to be caught in a dilemma between either de-contextualized cognitivism or a too pragmatic focus on specific contexts. To advance this state we need to understand how the second generation grew out of opposition to the first one; and how its ideals today are made impossible within its own thinking. Refusing central concepts like transparency does not help the advancement of HCI; rather a nuanced understanding of the meaning of such central concepts is needed.

III

Human activity theory, adapted from psychology and developmental work research, has been operational in organizing the insights of the second generation of HCI. It offers an account on HCI, which in some ways negates the basic ideas of the earlier approaches (e.g. Bødker 1991). Firstly, it emphasized that human action is purposeful and socially mediated, and consequently that the use qualities of a computer-based system emerge in the context of use. Conscious human action is always part of motivated activity, and it is carried out through non-conscious operations triggered by conditions in the environment and the structure of the action. Secondly, it emphasized that development is an ongoing aspect of the use situation. A behavioral pattern can be an action in one context but through automatization it can become an operation; the reverse change from operation to action happens through conceptualization when the conditions for an operation change.

The features required for an interface to become transparent can be explored based on activity theory. Transparency is not seen as a feature of the interface *per se*, but rather a quality of the user-artefact-object-context ensemble of the

use situation. In activity theory terms, an application becomes transparent when the user is able to direct conscious actions to the object of work (e.g. the novel the writer is working on) whereas the computer application as such (the tool) is handled through non-conscious operations. In an earlier paper together with Jakob Bardram (1995) we described how transparent interaction, from the point of view of AT, is achieved by ensuring that the operations required to operate the application are already established with the user or else to ensure that the interface can set conditions for the user's development of the relevant operations. We argued that the interface designer, mediated by the interface, set conditions for the user to set his own zone of proximal development when it becomes relevant, i.e. by placing non-intrusive clues that will appear for the user at the relevant moment. For this to happen, we emphasized development in use, i.e. that learning should be embedded in real, meaningful use situations, not as a separate activity. We further emphasized that the interface should strike a certain degree of initial familiarity for the user, and that it should enable the user to establish an image of the future use. Finally, we emphasized the importance of setting conditions for the formation and automatization of actions and in this way support mastering beyond sheer trial and error.

In our attempt to understand how to design for transparency, we were bending the activity theoretical concept of the zone of proximal development (*ibid.*). We did so by considering the interface to be a proper venue for social mediation between the designer acting as the adult and the user acting as the learning child; even though this "venue" was asynchronous and non-collocated. Indirectly this use of the concept of the zone of proximal development points to the importance of including a cultural level of mediated development in an understanding of how a computer application is not only a tool, but that the interface itself is also a medium in which the designer can make expressions and statements that can be received by the user and thereby support, or spark, the users development with the application.

We (*ibid.*) did not, however, break with the idea of the zone of proximal development as a more or less universally well-defined path to progress. For the practical application of our approach, the designer is stuck with the task of predicting what the users will need to do with the application. The dilemma is that we suggested that the designer should predict the curriculum for the users' development but at the same time we acknowledged unanticipated use as a basic condition in IT design. When use is emerging in use, it is impossible to write a curriculum beforehand. This dilemma is inherent in the second generation of HCI because of its unilateral focus on purposeful action and development within the culture of a specific community of practice. While the lack of focus on purpose and work context were the shortcomings of first generation HCI, these two foci have stigmatized the second generation, not least because they are in conflict with the widespread observation of the

same generation, that applications almost always are used in unexpected use.

IV

To address the problem outlined above, I will argue that it is necessary to understand use and design in a broader context than the community of work practice, and immediate purposefulness. We need a perspective that not only understands use qualities retrospectively in terms of natural affordance and canonical affordance crystallized in productive practice; we need a perspective that can account for how, and why, users' expectations and ways of perceiving and acting in context come about and change over time. Only within such a perspective we will be able to design computer applications that do not obstruct meaningful use.

I will suggest Wartofsky's (1973) analysis of the history of perception as a fruitful basis for such an historical account on perception and action should include a level of cultural and aesthetical analysis, but at the same time has to incorporate the insights of second generation HCI, including its understandings of reflection in transparency in tool mediated action.

Wartofsky explains that human perception is not an invariant factor in interaction, and that it is not independent of action. Consequently, he introduces a historical account on perception as an integral part of practice (not just a prelude to action).

"I take perception itself to be a mode of outward action" (*ibid.*).

Thereby, the sequential perception-decision-action loop, dominating most of HCI based on naive computer scientism, is broken. Perception changes historically in the course of changed practice, and the historical change of perception influences the change of practice. Thus, Wartofsky suggests a perspective in which perception is understood as being historically variable.

"...the very forms of perceptual activity are now shaped to, and also help to shape an environment created by conscious human activity itself" (*ibid.*)

In line with the activity theoretical account on the second generation HCI, Wartofsky understands perception to be mediated by historically developed artefacts. The distinctive human form of activity is constituted by the creation and use of artefacts, in reproducing the species, as well as in producing the means of existence. Wartofsky identifies two types of artefacts mediating productive practice. Primary artefacts are used directly in productive acts. Secondary artefacts are representations used in preserving and transmitting the skills and modes of acting that the productive practice is carried out by. Thus, secondary artefacts are representations of the modes of acting in production; they are not merely pictures of objects or environments relevant to production, but representations of modes of acting on and with these objects. A hammer is a primary artefact, a book

about carpentry is a secondary artefact and so is a plate in nursery school picturing various situations where carpenters work with their tools. A word processor is another example of a primary artefact, but integrated with word processors we often find fragments of secondary artefacts in help systems, and even in icons and other elements of the interface. Human perception is shaped by secondary artefacts as they convey forms of action and thereby form the action potentials we perceive. This is well in line with what has been claimed by second generation HCI.

V

However, according to Wartofsky, human perception is not only shaped in productive practice. In addition to the formation of perception taking place by means of secondary artefacts in productive practice, Wartofsky suggests another loop of imaginative construction mediated by another kind of representations namely tertiary artefacts. These tertiary artefacts are abstracted from their direct representational function.

"... [That] we see by way of our picturing, or our modes of representation, then, is to claim that perceptual activity is now mediated not only by the species-specific biologically evolved mechanisms of perception, but by the historically changing 'world' created by human practical and theoretical activity." (*ibid.*)

Tertiary artefacts have origins in the productive practice but do not depend on it in any direct manner. They constitute an autonomous zone of free creation of visions transcending the existing modes of perception and action in societal practice. Thus, tertiary artefacts re-shape human perception and thereby they influence and change productive practice. The representations Wartofsky points to with the concept of tertiary artefacts are those produced in the liberal arts, and the main point of his argument is to discuss the relation between art and societal practice in general.

"The artist, in effect, re-educates us perceptually [...] as styles or canons of representation change, historically, the world has seen changes as well." (*ibid.*)

Perception is not only shaped in our productive acts but just as strongly by our reception of artistic representations. Therefore, art and cultural expressions in general constitute a zone of reconsideration and remediation, and these tertiary artefacts can be seen as probes into productive culture, as well as a melting pot where new variations of productive activity take form.

VI

As argued elsewhere, mundane tools, including computer applications, exist in complex clusters of primary, secondary, and tertiary artefacts (Bertelsen 1998). The hammer is a primary artefact for driving nails. The hammer exists in a complex with secondary artefacts representing practice with hammers some of these secondary artefacts may be remembered from the plates and children's books in nursery school

and represented later on by the hammer itself. The tertiary artefacts coupled to the hammer are by definition harder to identify, but the hammer points to the artistic representations of hammers and hammering as the prototypical crafts activity, and it points to the potential poetic meanings of the word hammer. In this way the hammer has a certain amount of tertiary artefactness attached.

In the original sense of the concept, a lot of computer-based works of art are tertiary artefacts that seem to have potentials for changing productive practice with computer applications. As pointed out by Bolter & Gromala (2003) the majority of computer arts in a fairly direct, and often explicit, way addresses the new ways computer applications mediate our relation to our surroundings and ourselves.

Designing computer applications with built in, but clearly distinguishable, tertiary artefacts might be an approach in some situations, creating a clear hybridity of the interface (cf. Manovich 2001). However, as a general design approach I will suggest a focus on elements of tertiary artefactness integrated with the tool interface, allowing for poetic openings into contingency and imagination. Thereby, supporting the development of transparent interaction without prescribing a specific curriculum.

With Wartofsky's concept of tertiary artefacts it seems promising to reformulate HCI as an aesthetic discipline that will enable us to break out of the conceptual limitations of purpose and function and still focus on the dialectics of the use situation. In such a reformulation based on the concept of tertiary artefacts (and clusters of artefactness) it will be possible to bridge between the insights of second generation HCI and the newer views that discard the concept of transparency and the tool perspective in general. Within such a new discipline, it will be possible to reconsider the dilemma between "curriculum for use" and "unanticipated use" we were stuck with in our earlier exploration of design for transparent interaction (Bardram & Bertelsen *op. cit.*).

VII

The distinction between the transfer of established modes of action mediated by secondary artefacts, integrated into day-to-day productive action on one hand and the reformation of perception and expectation mediated by tertiary artefacts in an offline loop not directly integrated into productive action on the other, enables a more detailed analysis of the limits for development in use. The tertiary artefactness of mundane tools consequently defines a parallelism of various types of mediation in use; this parallelism may, or may not, be spatially and temporally intertwined in the course of purposeful action.

Because tertiary artefacts is an aesthetic concept, Wartofsky's analysis leads to an extension of the concept of social mediation in activity theory beyond the confines of group interaction and the well-defined curriculum embedded into the interface. Development, including development in use, is culturally mediated. Consequently, a cultural unit of

analysis can be introduced. The interface should also be understood as aesthetics and as an art form. Not only the functionality and the cognitive match but also the cultural roots and impact should be understood, e.g. by applying methods from the analysis of liberal arts in the analysis of computer applications (Bertelsen & Pold, 2004). As the cultural formation becomes a basic unit of analysis, the aesthetic perspective offers an actual handle on the users expectations in the specific cultural formation. Thus, it may be possible, although complicated, to design for non-intrusive clues that become apparent right on time.

VIII

Currently, many writers emphasize the cultural and aesthetic dimensions of technology. These contributions indicate that technology today is important beyond the workplace, and they point to a general reorientation.

While writers like Bolter & Gromala (*op. cit.*) tend to interpret this reorientation as implying a break away from the ideal of transparency, it has been pointed out above, that transparency and reflectivity are interdependent aspects of computer mediated activity. Transparency at some level is a preconception for reflectivity at other levels, and reflectivity is needed for the initiation of the learning process leading to transparency. More specifically, activity theory has pointed to the importance of the dynamic alteration of the tool being in focus and outside focus.

However, as illustrated with the Bardram & Bertelsen paper, there is a missing link from understanding that transparent interaction is developing in use, in unexpected ways, and to be able to understand, in a design oriented way, how this development takes place.

By introducing Wartofsky's concept of tertiary artefacts, mediating the historical development of perception as action, it is possible to integrate the transparent tool perspective with a theory of art as innovative practice - or, in more general terms, to integrate the work practice-oriented second generation with the new aesthetic orientation. Thereby re-constituting HCI as a new discipline. I have argued, in this paper, that this new discipline can be based on dialectical materialism as expressed in activity theory and in Wartofsky's account on perception and aesthetics; in particular because such an approach seems to be both sufficiently pragmatic, and sufficiently value driven. Thereby it is possible to avoid the idealisms and subjectivisms some of the current aesthetically oriented accounts on HCI tend to subscribe to.

The dialectics between transparency and reflectivity in tools and in art will be central in the further development of HCI into the third generation, and in setting a new agenda for theories in digital aesthetics. Transparency is in a way al-

ready important in art. Even when "the medium is the message", artistic expression depends on moments of transparency, e.g. of certain material features of the work; we are not just seeing canvas and paint when we look at a painting. Dealing with everyday artefacts, such as computer applications, will be a driver for theoretical aesthetics, emphasizing the relation between transparency and reflectivity. It was realized within second generation HCI that transparency was a developing feature of the use situation, but it was difficult to account for the dynamics behind its development and how it could be supported by interface design. In the future third generation HCI "the cultural", including digital art, will no longer be considered a stable backdrop for HCI, it will instead be understood as the level constituting the dynamics of HCI. The emergence of aesthetic computing as an intertwined field of science and liberal arts will become an important resource for basic research in future HCI research because it is concerned with the tertiary artefactness of computer-based representations.

IX

HCI has seen a development from a focus on "natural" affordances, over a concern for canonical affordances crystallized in societal productive practice, to the aesthetics of the interface as a key to understand good interaction. With the concept of tertiary artefacts, and the idea that mundane tools exist in complex clusters of primary, secondary and tertiary artefactness, it is possible to integrate these three levels of concern in a new third generation HCI.

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Position Paper for the Aesthetic HCI Workshop

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ABSTRACT

The primary assumption that will be taken up in this position paper is, that computational devices and interfaces are becoming more and more pervasive, and that computing in various guises is a core feature of our current way of life. This “digital texturing” of our life-worlds is all but stating a fact. Yet from its inaugural conceptualizations in the late 80’ies, ubiquitous computing has been dominated by a totalizing vision of new embedded, distributed and interconnected technologies as antecedents of increased efficiency, convenience, functionality, transparency and unobtrusiveness. Albeit important and necessary attributes of technology, I wish in the following to focus on how we can live “with” technology, how our relations with technology are shaped, and what possible role aesthetics might play in a shaping of pleasing, rich and acceptable relations between humans and a (digital) machinic environment.

I apologize for any longwinded discussions, and the occasional incoherent, rambling nature of this position paper, and especially for going such a long way around the subject of aesthetics, but as it is, I feel that a “setting the stage” is better than plunging into practical perspectives. Also I would like to stress that this is a work of “speculative HCI” (though not of the scenario kind) that takes its theoretical outset somewhere between sociology, philosophy, cultural studies and futurology.

Author Keywords

Aesthetic HCI, Technology as other, evocative objects, attachment, philosophy of technology, speculative HCI

ACM Classification Keywords

DE-SUBSTANTIALIZING TECHNOLOGY

The point of origin for the conception of an aesthetic approach that I wish to pursue in the following takes its outset in broadly phenomenological theories. This is why: First of all, I believe that understanding aesthetics in relation to a technological practice ought to also entail a de-substantializing of the technological object – that is, a move away from a view of technology as an object (with a certain look, features etc.), towards a view of technology as a mediator of experience, that is, technology as affording a certain experience of, and relation to, the world and itself [6]. Phenomenology, quite simply, should therefore here be

understood as an approach that understands objects, not as discrete units for manipulation, but as “relational ontologies”, units that come into being in human engagement. I believe that aesthetics are essential to this understanding, as the functional *action* (as opposed to experience) can be said to be only one (limited) aspect of the engagements we have with the world – driving a car is not merely an *action*, the action of getting from point a to point b, but also an experience, very much dependent upon the relationship to the world the car affords (e.g. does one drive a large comfortable limousine with tanned windows or a charming old 2CV makes all the difference). Now, the question for the present is not merely “how we experience through technology” but also “how we experience technology”, even if it must surely be discussed how these two perspectives relate and overlap (experiencing *through* technology is an inherent part of any experiencing *of* technology). Yet for the current purpose the “experiencing of technology” becomes primary for an understanding of how we relate to a comprehensively computerized environment. My claim is that there is more to ubiquitous computing than mere functionality, that simply “getting stuff done” is only a (perhaps) very limited part of what ubiquitous computing is about.

EVOCATIVE OBJECTS – TECHNOLOGY AS (UNCANNY) OTHER

A persistent “fantasy” of technology is *technology becoming other*. Traditional modern conceptions of technology entail an absolute human mastery over technology and the services we gain from applying various technical solutions. This notion is challenged by cultural theorists such as Donna Haraway (with the notion of cyborgs, see [5]) and sociologists/anthropologists such as Bruno Latour (boldly stating that “we have never been modern” and asserting a notion of “hybrids”, see [7]) who argue that human mastery and machines is, at best, an illusion, a remnant of rationalist and enlightenment idealizing, that artifacts have indeed intentions and agency, and that human-technology relations should be seen as a hybridization of both – technology is thoroughly interweaved into the human subject and vice versa. This interweaving, one might argue, is in one sense the same as transparency – once you blend with technology, you don’t notice it, it becomes transparent and you can focus on performing certain tasks with your cyborgs body (like when driving a car, playing a computer game). The borders

between you and technology become blurred. A related aspect is the amount of agency consciously or unconsciously bestowed (or “inscribed” as Latour would have it) in the object. The car/body hybrid becomes yanked out of the apparent harmony in a hectic maneuvering that entails the engagement of the cars ABS and Electronic Stabilization Program, for those brief, nerve-wrecking seconds delegating agency to the machine rather than to the driver, possibly saving her as well as its own machinic life. The car, in instances like this, discloses itself as a complex reactive unit rather than an innate, unthinking piece of metal and wires, and, breathing hard afterwards, we are able to declare, “my car saved my life”, as if it actually wanted to, as if it was a act of benevolence.

Autonomy of complex machines, the fact that complex computational environments take on an unpredictable, agential character is an inherent trait in the complex web of interconnected digital devices that will come to occupy (and to some degree already occupy) our lifeworld.

To take the notion further into a seemingly science-fictional landscape, the (uncanny) notion of sentient or animate technologies (such as in e.g. Ovid’s Pygmalion, der Golem, Frankenstein and, well...Pinocchio) is a recurrent theme in the cultural construction of computing technology e.g. in movies such as Terminator, HAL9000, Wargames or in the Y2K press coverage leading up to the change of the millennium, evoking an *unheimlich*, almost spiritual sense of the overwhelming networked complexity and the incapability to anticipate how it would behave at midnight Jan.31, 1999.

I believe that ubiquitous computing might be seen as leading further towards the *de-stabilizing of the modern subject* inherent in the abovementioned perspective of hybridization, as interconnected, invisible and cognizing computing technologies will increasingly pervade our immediate environment. This, incidentally, is to be seen as a neither utopian nor dystopian perspective, but rather as an epistemic condition for our relational engagement with technology.

Computers, because of their highly interactive mode of functioning (e.g. we can speak to it and it *speaks* back in that most human of communicative modes), arguably come closer to fulfilling these fantasies, on a more perceptible level – computers are indeed evocative objects – suggesting life, agency and (quasi)-subjectivity.

A central feature of ubiquitous computing, and a feature that distinguishes it as a technology radically different from, say, desktop computing, is context awareness. Now the computer does as we “mouse-click” it to do, but the vision of ubiquitous computing is one of sensitive, indeed sentient and cognizing technologies that can understand and act according to a set of contexts. Sherry Turkle, writing *The Second Self* [11] and coining the term of the evocative object in the very same, could not possibly have imagined the degree of interactivity now bestowed on the human-

computer relation, and the amount of agency proposed to be assigned to the machine itself. So, yes - evocative indeed! Yet the machinic life that computers become bestowed with, both in practice and in the cultural construction of the computer as an object, cannot be sufficiently subsumed under the functionality label. Ubiquitous computing technology is understood as technology that disappears (as “seamless computing” to user Mark Weiser’s words – in a continual move from the desktop to the built environment (in the shape of e.g. motes, sensors etc.), to small appliances (various mobile devices), in everyday objects (as e.g. Radio Frequency ID tags) etc. Invisibility, or rather perhaps transparency is believed to be the primary goal for designers of technology, but in terms of relating to the technology as other, transparency, indeed invisibility, lacks the embodiment and the presence required for any real *engagement*. Engagement and attachment, like in human-human relations, are the preconditions for trusting, lasting, pleasurable and rich interactions. This, arguably with some proviso, is also the case with human-technology relations.

To ensure that the life-like entity that is the ubiquitous computing environment becomes some(one/thing) that affords attachment, I believe that aesthetics, the aesthetics of presence, of embodiment, are central concerns to take up. This is where the strong symmetry claimed by e.g. Latour, Haraway etc. must probably give to a notion of designed or inscribed “affordances” of attachment – after all there are human designers involved.

THE AESTHETICS OF ATTACHMENT

By now I have discussed the need for a consideration of existential problems inherent in a thinking that emphasizes “living with” rather than “using” digital technologies such as those we understand under the ubiquitous computing label. Now I wish to turn towards experiential aspects of these issues and consider some points for an aesthetic engagement with technology as other.

Consider technological objects to have 3 properties in terms of its relation to the human subject: a functional, a semiotic and a material. Firstly, an object has some kind of function, it relates to the subject as a user, promising the fulfillment of a task. The relation here is one of instrumentality. Secondly, an object (often what we would call a *product*) has a semiotic property, a signaling of some kind of culturally embedded meaning, a style or a certain characteristic. The relation is here one of expressing. Thirdly, an object has a certain materiality, a certain way of being. The relation here is one of experiencing. While traditional engineering approaches have favored the cultivation of the instrumental relations, marketing and product-design approaches have generally cultivated the second. The third property of objects could be said to be closer to the concerns of aesthetics, and could arguably become one primary concern of interaction design (witness e.g. research in haptics and tangible interfaces).

The “material aesthetic” concern can be seen as one of embodiment, presence and how the human actant in a techno-social space is presented with technologies that have a significant “body”, a presence to the *senses*, rather than being a mere instrument for action or a vehicle of certain meaning.

In this sense materiality is the property that engages attachment rather than distance or transparency and arguably also a property that engages the human *affective* apparatus. Materiality, and hence potentially attachment, requires engagement with the object, whether it be a physical object or an interface representation.

While functionality is interchangeable in the sense that any other technology that could help us reach our objective could take its place, and while the semiotic properties of objects are constantly, unpredictably changing (and also interchangeable with other objects that elicit the same style or identity), perhaps the material aspects of technologies are of a more lasting value? Note that talking about the material aspect of digital technologies of course has (at least) one difficulty – how to understand computational *representation* at an interface level as material? As I understand it here, materiality is not a return to a Platonic epistemology (and thus to representation), nor is an understanding that divides between hardware (boxes and wires) and software (where the actions take place) but an understanding that points to both a situatedness (spatially and temporally) of interaction (so very important in context-aware computing technologies), reinforced by a pragmatic (and/or constructivist) understanding of texts as materiality, not merely representations of materiality. A digital environment can be seen as a text, but has material (if numerical) consequence both *in the world* and “*as a world*”.

The “aesthetics of material human-computer attachments” could be understood as an inquiry into the aesthetic logics and forms that *create and maintain affective bonds between the human actor and a digitized environment*. That is, bonds, which are not primarily functional in nature, but bonds created through emotionally pleasing, complexly structured interactions – see below for a tentative list of features that might engage this kind of relating.

Consider again, if you wish, cars: While the function of the car is, in a general sense, interchangeable with other vehicles of transportation, and the semiotic expression inherent in driving e.g. a “sporty” car or a “nostalgic” car are interchangeable with other cars that exhibit the same expressional, cultural logic, the very material properties of a “special” car which is “my” car (“every dent tells a story”), not in a commodity perspective but from an perspective of *affection*, cannot be replaced by any other car. We readily declare our affection for seemingly inert objects, cars, houses, old lamps, revered books etc., not necessarily because of their functional or semiotic value that allow us to *do* or *express* certain things, but because of some trait of its being a thing with a history or an object that becomes

even more attractive over time because of certain material features (e.g. a leather sofa that acquires a beautiful patina over time, rather than simply deteriorating). Objects such as these have certain traits that allow for various levels of intimacy and attachment.

I suspect that there’s an aesthetic logic underlying the material features of attachment, a logic that takes its outset not in any functional conception of technology, but in how technologies present and express themselves as other, and I will briefly outline some elements that strike me as important to this respect. Some might overlap in subtle or not so subtle ways.

Firstly, *embodiment* seems to be a relevant, if pretty basic, parameter for attachment. Simply designing for the solving of tasks, and hence aiming towards transparency does not allow a human subject to experience the other as anything but a means to an end. Embodiment does not necessarily mean physical manifestation but, being a concept derived from phenomenology, it also involves a grounding of experience in an everyday, lived praxis. The interactive phenomenon of using or experiencing something through a digital computer demands both physical presence accessible through the living body and a variety of situated, meaningful phenomena (social, situated knowledge). This means that a precondition for attachment is situatedness, meaningfulness and a physical expression – attachment needs and interface, a place to have experiences.

Punctuation could be said to be an intrusive expression of an object. Rather than being a time-in background phenomenon, an object of attachment would require the possibility of time-out instances – instances that would enable reflection, enjoyment and perhaps puzzlement. Our affective attachments to objects require that they are not merely things through which we *do* stuff. They must afford occasional reflection.

Presence, closely related to embodiment, has been developed in a seminal article by Halnäs & Redström [4]. In this article, presence is a feature of things that enter successfully and in meaningful ways into our lifeworld. Quoting from Borgmann’s concept of “focal things”, objects that are present are “[things] that asks for attention and involvement: they desire a practice that cannot be characterized by consumption but by engagement”.

Friction, perhaps, is also a parameter to consider – the ability, or the potential, to act in unpredictable ways and the entailing complexity of not being able to predict the other with absolute certainty (the blackbox, or double-contingency problematic), is a trait that substantiates the need for trust in both human-human and human-machine relations. Without this moment of uncertainty, why even consider trusting the other – if we are (rationally, statistically) certain of a specific outcome of an interaction, trust is all but unnecessary. As such, a concept of friction is also a concept that goes beyond the perspective of a human experiencing an object as present or relevant – it is a step

towards inter-subjectivity. While we can occasionally ponder the inner mechanics of computers, rarely do we actually consider what goes on between input and output. By introducing “quirks” (and of course we need to consider – what are “good” quirks – a car that doesn’t start is not just quirky, it’s a pest!) attention is drawn to the machine as an “other”, as a subject with intentions, motivations and personal characteristics. Perhaps Dennett’s notion of the “intentional stance” could be useful for understanding this perspective (see [2]).

Designed friction, contingency, involves the “quirks” and peculiarities of some of the objects that we become attached to – the car that has to be treated “just right” to start properly, small ritualistic routines like kicking the television to make it work, or things that only I know; like twisting the key to my house in a certain way, thus perhaps making the house more personal because a certain specialized knowledge is required to enter etc.

Perhaps Dunne’s term “para-functionality” (see [3]) comes close to capturing the essence of friction, of the possibilities in design not only for a functional or pleasurable approach, but also for estrangement and “attitude” as valuable approaches to design.

Dynamics, as a narrative feature, should ensure that the common history of humans and a specific technology (think e.g. a smart environment or ambient intelligence) is changing over time, thus allowing a common history to be built. A bio-mimetic approach to design, involving mutability, self-organization and evolutionary criteria could be seen as a way to obtain a temporal and spatial dynamics. The simple principles of this bio-mimetic aspect of attachment can be found in the Tamagotchi electronic pet or Sony’s “neural network” robotic dog Aibo.

POST-SCRIPT AND PERSPECTIVES

Perhaps we witness, in the aesthetic approach to the relation between computers and human actors a rekindling of the spiritual, of the aural qualities, the loss of which Walther Benjamin lamented – on the other hand, perhaps the modernist equaling of technological reproduction and automation with rationalist production and pure functionality is becoming increasingly blurry and problematized (witness the collage, montage aesthetics intrinsic to the digital aesthetic, see. e.g. [8]) – aesthetic and functional practices become intertwined in ways enlightenment philosophers would not even begin to consider, and culturally now we are witnessing a (modest) post-human, science-fictional move towards the machine as the other, not merely in highbrow academic newspeak vis-à-vis post-structuralist lingo, but also in popular (and empirically grounded understandings, for an example of “media as other” see [9]) understandings. The rapidly growing complexity of digitalization, of embedding invisible systems and thus engulf our environment in a constantly interconnected “Hertzian space” [3] of autonomous, cognizing, context-aware technologies does

not merely bring functionality at our fingertips (“always, everywhere”), but also challenges traditional understandings of what technology is – if clothes (arguably a rather transparent technology) become digitized and “connected”, how will our understanding of the relation to the world change?

Potentially, I believe that overpowering complexity that a pervasive digitization brings about, and the reflexive notions of our inability to actually (and perceivably) control the technologies that we place in our world (see [1]), can be summed up in one word: Risk. Risk, socially constructed or objectively real, basically means high interaction costs, in terms of cognitive workload (we have to constantly consider and rationalize our relationships), and thus emphasizes a need for trust as a mechanism for reducing complexity. Trust in human-human relationships thrives on familiarity, knowledge, positive emotions, attachment, reliance etc. Thus the aesthetics underlying the attachments described above are arguably also the aesthetics of trust?

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Introducing Excitability!

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ABSTRACT

This position paper argues as to *why* it seems pertinent time for approaching the notion of aesthetics in HCI. By admitting to and elaborating on a notion of use situations and contexts beyond usability, the paper introduces the concept *Excitability* as a conceptual juxtaposition to traditional HCI vocabulary.

Author Keywords

Aesthetics, Affective interaction, beyond usability, New Media,

INTRODUCTION

HCI in general is often seen aesthetically oriented towards simplicity and beauty primarily serving as driver for the prime goal of the interface: usability. But we might also think of use situations that are *too* usability-minded, ultimately leading the use situation to become tedious and instrumental. Here I would like to propose the term, *Excitability*. It might be seen as a deliberate opposition to usability, but the intention is to establish some relative link between the terms presented below, there might be established balanced approaches somewhere between the two positions.

Where Usability is:	Excitability is:
Functional	Artistic
Transparent	Ambiguous
Efficient	Exciting
Learnable	Memorable
Easy to use	Inspiring to use
Rational	Affective
Comfortable	Peculiar
Measurable	“Tellable”
Predictable	Surprising
Conventional	personality
Simplicity	Exceeding

So what is *excitability*? *Excitability* can be defined as: the ability to create and facilitate a certain amount of *excitement* in the use situation, eliciting emotional responses, critical senses or notable significant experiences. *Excitability* points towards the instances of some sort of affective “excess”, a surplus of meaning or action that arises in the use situation or from the use context. *Excitability* is occurring when there is *more* to the use situation than *just* use.

Usability approaches focus extensively on functionality and ensure that interaction is kept *non*-affective to the user and hence entail a diminution of the any excessive possibilities in the use situation. Usability testing often reveals those moments when the user must think about, and occupy her self with, the interface, rather than the task at hand, and usability often cuts away unnecessary cues and other possible distractions away. After seemingly lacking non-utilitarian concepts, the term “User Experience” has emerged recently to expand the usability terms. Though it seems to encompass an understanding of users and their experience and while it does state that there is more than usability to use, it ultimately seems assesses experiences as something planned and packed. *Excitability* aims at pointing to those situations that offer experiences from a more “ambiguous” outset for use the situation, a concept derived from Gaver [7]. *Excitability* arrives from a position where not all options are given beforehand, where certain possibilities are yet uncovered, a situation where chances need to be taken. Where the object or the interface, not demands, but encourage or stimulates an affective investment from the user, entailing exactly an to a more ambiguous experience. Aesthetic experiences often are more affectively pronounced when deriving form unpredictable situations point than from foreseeable obvious ones.

HCI success-criteria are often chosen valid if they are measurable and accounted for by quantifiable sets of data such as time used, tasks completed, etc. collected in often constructed unnatural test-situations. *Excitability* might respond to other aspects of the use situation, as to *why* users would use an object rather than being occupied with specific outcomes of the use. What factors are implicit in the use situation, not accounted for by usability-measures, instead of seeking to learnability of a use situation, we

could also ask if the use situation is at all *memorable*? Instead of asking if the use situation is measurable, we could ask is it “*tellable*”? Can we express, read, interpret, analyze or portray what is in the use situation, without these subjective factors? Where usability tells us that interfaces and products should be ease the use, we might also find it reasonable that something are inspiring to use growing with the use, or it might even be demanding or challenging, in order to remind of i.e. potentially excessive overuse of technology (why is the car for instance so easy to use? when it is potentially dangerous and polluting). Rather than making the interaction conventional, safe and accountable, we might also find situations that are surprising, varied and - leading to an extension of the experience of use, entailing more profound characteristics of technology that surround us. These attributes are often not accounted for in the usability approaches, and are often not approached in HCI research as such. While usability is still a distinguished factor it is not enough to label the current use situations and contexts of use.

The current use of digital computer interfaces is increasingly becoming a host for and a distributor of cultural data and a platform for experiences i.e. from the use of Internet applications, websites, computer games or interactive movies etc. We also see cultural aspects emerging from productivity-software that increasingly allows us to manipulate, store and distribute texts, images and sounds in new and excessive ways. We might even see operation-systems, such as the Mac OS X or Windows XP, becoming expressive media-like cultural objects. The modern computer seems better described as a *new media* object, than a control interface as conceptualized in traditional general-purpose HCI. Hence an expanded notion of aesthetics of use and design, like excitability, within HCI is becoming increasingly important to envision. As we might expect that HCI research is no longer purely a concern of making tools for augmenting human efficiency and productivity. Increasingly the subject matter of HCI is dealing with and augmenting, more excitingly, the experience of social and cultural contexts and situations in the everyday life-world of humans. These situations and contexts are often more inherently driven towards the characteristics of excitability than those of usability.

PROLIFERATING USE CULTURE

What significantly defines computer technology today is not that it is used as a tool for productivity, rather that it is increasingly used as a media for handling of social networks, communication, creativity, sharing “soft” information – text, images or sound rather than processing “hard data”. We see that new digital technologies embed deeply and rapidly into our private sphere, increasingly becoming useful as well as exciting features of our everyday and available anywhere, via wireless local and distributed networks and that mobile platforms: laptop computers, PDA’s and mobile phones etc. proliferating in use. In some respect technology has become an immersive

part of the experience itself, or the excitement, has become the purpose, as when with playing computer games or browsing the Internet, or using mobile phones for text or image messaging etc.

We might say that technology is no longer just a matter of enhancing the technical infrastructure, but also increasingly, a challenge for enhancing and stimulating the social infrastructures that emerges among users in the melting pot of computer/communication technology, media and the rapid changing cultural vogue of contemporary society. Hence digital technology is perhaps better understood, designed and evaluated in the image excitement as “how we may live” or “feel” to rephrase Vannevar Bush’s iconic dogma “as we may think”, that for significantly intermingled human senses with technology.

The focus on ease of use, usability, work-related and productivity-based use contexts has been predominant in HCI – and while still a laudable goal, many “everyday” use contexts and more loose modes of use, have been left relatively untouched. Hence i.e. Usability measures and methods might even entail a “de-humanization”, as recently stated by Jordan [10]. With excitability we might bring a set of more humanly vivid labels back into the description of the use of technology. It seems as if traditional use contexts are coming to a threshold, due to a number of factors. Notably societal and cultural changes have unleashed “post-traditional” environment on individual, organizational and societal levels [3]. In this context our social practices must be seen as increasingly *reflexive*, and our tools and environments therefore must adapted more to our increasingly reflexive life-world, and possibly be able to go along in the foundation of new interaction forms that enables and support the everyday life in a more lively way.

This development was somewhat anticipated in Weiser’s vision on ubiquitous computing in the early 90’s [16]. But while Weiser quite accurately estimated that computing would embed potentially everywhere, his idea of this being a “weaving” seamlessly into our everyday life, becoming practical invisible for the user, seems to weaken. It seems more likely today that computing has become more and more opaque to our perception and ever-present in our surroundings. From this perspective, it seems more likely, that aesthetic factors are just as crucial as functional factors when designing for human-computational interaction. While it seems a laudable goal that interfaces are easy to use, transparency, as pointed out by Bolter and Gromala [2], is inherently a *myth*, as computers is not like an automobile or a toaster, it feels a lot more like a media, and should be assessed from more “reflective” stances. This has also recently been called for in HCI [5, 6,15].

HCI RE-SITUATED

Human computer interaction can no longer be preset to a certain use context i.e. the office or the like, but is increasingly more randomly *situated* in proliferating new cross-contextual use situations. Hence the subject of study

for HCI has ultimately become vividly diverse, from approaching the limitations of technology in terms of usability, ideal transparency and efficiency in interaction, we might also want to understand interaction from more experience-guided approaches, and envision stronger views on aesthetical aspects.

While it seems obvious as to why usability and functionality has historically taken a central position in design heuristics and evaluation methods of HCI, this position has often entailed aesthetics to *follow* function, perhaps nurtured a predominant narrow notion of on user culture, the “experience” of use and placing the “optimal” form of interaction with computer technology, as mere information processing. These notions are currently under siege, as use of technology and interaction is proliferating *beyond* the traditional use context toward more ubiquitous and pervasive settings. In this relation we have seen a rising number of terms, concepts and related fields addressing this. Hence the use situation has been seen in direction of i.e. ambiguity [7], enigmatic [9], enjoyment [1] and the irresistible [14] aspects of affective and aesthetics or objects in general. These approaches are investigations in interaction and use situations in general, that critically go beyond the HCI paradigm. Other researchers like Anthony Dunne [4] actually speaks against core concepts in the HCI package by appropriating objects and environments with a notion of aesthetic or *poetical* abilities, by featuring an *estrangement* or gentle *alienation* in the use situation. Dunne rather radically speaks about *in-human* or user-*un*-friendliness factors applied to the product-user relationship in order to highlight the obvious falsity of the transparency dogma, and moreover, Dunne and others draws to our attention that products and interface can and could be appropriated with a notion of excitement, surprise and other kind of ambiguous properties in order to evoke or elicit emotions beyond numb and transparent use of technology.

AESTHETICS IN HCI

Aesthetics is a concept that not easily position it self clearly in relation to HCI, as aesthetics is *both* a naturally part of the HCI thinking, as HCI works from an functional aesthetic direction, while more art-like and radical aesthetics are often seen apart from or opposite to HCI, as these aspects not easily validates in the large perspective and generally is presumed to be counter-useable. Indeed aesthetics is a hard concept to discuss in the first place. Obviously, as recently put forward by Donald Norman, who have revised his strong position on functionality; aesthetics do matter! But how? And why?

Normans approach to aesthetics is perhaps predominant to HCI thinking, as he seems to understand aesthetics as “beauty” or “simplicity”, and places this in the triangular relation between *aesthetics* (visceral), *functional* (behavioral) and *symbolic* (reflective) aspects. While we often easily can *describe* these obvious features of an object, say a teapot or a mobile phone etc., in terms

pleasure or beauty in appearance, ease of use and some socio/cultural implications, it becomes more difficult to distinguish these aspects, when we think, more holistic about contextual occurrences of everyday life?

Hence we might enhance the understanding of the use of computer technology by looking broader towards use as an “event” unfolding and intermingling in a variety situated contexts, rather than planned and designed “experiences”, as also recently suggested by Malcolm McCullogh in his recent book *Digital Ground* [12], where he states:

“When conducted according to behaviorist notions of inducing demand, “experience design” seems overly manipulative, culturally sterilizing. But when allowing for unforeseen activities, this latest stage in the trajectory of human –computer interaction has high potential for cultural expression.” (McCullogh 2004:162)

In criticizing this narrow mindset of HCI, Hallnäss & Redström [8] suggest a philosophical approach to design. Envisioning the coming ubiquity of computational objects Hallnäss & Redström argues for seeking towards aesthetic “meaningfulness” rather than focusing on increasing productivity. Aesthetics here is seen as the basis for design, as a way to create meaningful objects and systems and not simply “icing on the cake”. Aesthetics is the point of departure for the enabling a stronger focus on *presence* rather than on *use*. Meaningfulness does not arrive from efficiency, but appears when we have the possibility to *engage* and to become excited and develop affectionate relationship, beyond the functional aspects of use.

Thus bringing HCI into new aesthetic interaction paradigms is likely to be a natural advance, corresponding to societal and cultural progression. Where usability and general HCI previously was the main paradigm for dealing with and reducing complexity in the use situation. It seems likely that this has produced a culture with a somewhat instrumental outset, which not easily endorse aesthetics. Therefore this paradigm is increasingly unfit to handle the rapidly changing cultural background of computers, as it is pending towards more ubiquitous and pervasive use contexts and qualities. New paradigms are needed.

CONCLUSION

In this paper I have tried to discuss as to *why* aesthetic and affective use situations are becoming a persistent topic of interest. And it seems clear this is purposed by factors that relates to a new cultural role and a changing. Introducing the term *excitability* we have merely drawn attention to a concept that goes beyond a traditional HCI paradigm. I obviously intend to develop the concept further to see it appropriated, and developed into more operational approaches and methodology around the concept.

But a discussion of *excitability* offers an inherent call for contextual and conceptual expansions on the traditional labels of the use situation. The terms might offer a much-needed end of the use spectrum from usability. The concept

is not intended to define any exact, optimal experience. Rather *excitability* is about setting a juncture for aesthetic and inherently more interesting interaction forms to occur, not limiting aesthetics to be merely “the icing on the cake”. Instead the excitability is about creating and highlighting that use situations can exceed and excite, beyond the predictable and “sterile” user experience. Not just for sheer fun or more *artistic* interaction, but more over to stimulate more creative, sustainable, engaging, meaningful, critical and more culturally significant contributions to human use of computer technology. In fact by turning HCI in direction of a more aesthetic conscious mindset, there might be a linkage more interesting use situations, enabling also more critical and reflective awareness on the situational everyday use arising with the increasingly proliferated presence of digital technology.

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Interaction Design Aesthetics – A Position Paper

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ABSTRACT

Interaction design introduces a shift in focus; from the things themselves to the acts that define them in use. Interaction design aesthetics, as a logical foundation of design practice, also introduces a shift of focus; from design by drawing to design by act defining. It is still a matter of understanding the intrinsic relationships between abstract form and concrete expression, but within a different context. This means that we have to revisit the notions of form and expression and try to understand them from a somewhat different perspective.

Author Keywords

Interaction Design, Aesthetics.

ACM Classification Keywords

H5.m. Information interfaces and presentation.

INTERACTION DESIGN AESTHETICS

The basic purpose of systematic design aesthetics is to explain the logic of design practice, i.e. to provide a logical foundation of design practice. The notions of form and expression are central to such an explanation; design is after all, in a certain sense, all about shaping, defining the actual appearance of things, systems, we form the expressions of things in the process of designing. This is clearly visible in the “basic course” (Cf. [Itten]) at our design schools where we study the “basic laws” of color and form and at our art schools and music schools where we study the “basic laws” of form and material in some way or another.

The notion of “form” we usually refer to here is based on the old distinction between form and material; form concerns the way in which material build things, i.e. the geometrical form of spatial things, houses and cars, and the serial form of temporal things, music and dancing, etc.

If “form” refers to the way in which material builds things, then “expression” refers to the way in which things presents themselves to us, it is a notion that relates to the form of presentations. It is natural to think of it as that notion dual to “impression”, i.e. the way things themselves appear in contrast to the way in which we see them – it is a “naïve” distinction we refer to here, all those epistemological problems involved in such a distinction is really another matter. When we say that design means forming the expression of things we simply mean that in the process of designing we decide the way in which a thing actually will appear; through color (the green jacket), texture (the soft pillow), sound (the almost silent motor), behavior (the smart interface) etc.

If product design is all about expressing things, function, then interaction design somehow is all about expressing use, interaction. How can we understand the notions of form and expression in this context?

Interaction design is usually associated with use- and user oriented design of computer based products and systems. But designing the “interaction” with products and systems is, of course, also of more general interest in industrial design as a whole.

“There is a common misunderstanding that interaction design is concerned fundamentally with the digital medium. It is true that the new digital products have helped designers focus on interaction and the experience of human beings as they use products. However, the concepts of interaction have deep roots in twentieth-century design thinking and have only recently emerged from the shadows of our preoccupation with ‘visual symbols’ and ‘things’ “. ([Buchanan])

Interaction design is, in this sense, a basic component of the general industrial design process. It is a matter of designing the acts that defines intended use of things and systems. Designing computer interfaces and computational interaction devices is a part of this, but nothing that defines interaction design as a specific area of design.

Interaction design is a central component within the process of designing computational things and systems. But it is the

computational material that makes this a specific area of design and not some particular “interactive” property of the things and systems we design.

As the computer itself disappears in the background computational technology reappears as a new expressive design material. We build things with a new material; we build computational things.

What is typical for these things is simply that their behaviour in use depends on the executions of given programs. This material is just like the material of music a time-material and it shows itself only when we use things. (Cf. [Hallnäs, Redström 1]) To understand the expressiveness of computational technology as material is of course essential here; it is a new temporal material that is becoming just another common industrial design material.

A basic issue of aesthetics is then to investigate how the expressiveness of computational technology builds the expressiveness of use; in many ways a challenge for experimental interaction design, i.e. practice based interaction design research. (Cf. [Seago, Dunne], [Glanville])

THE ISSUE OF FORM

Interaction with computational things is in many daily situations nothing more than ordinary use of rather ordinary things; it is difficult to maintain a basic distinction between “interaction” and “use for” etc. Here it is useful to consider the following distinction between function and interaction; function is what *things* do as we use them, while interaction on the other hand refer to what *we* do when we use a thing.

When we use a modern washing machine the machine washes and that is what we do too. But “washing” then means different things. The machine is doing the actual washing in some sense while we handle and monitor the machine. We design the machine with respect to both these aspects of “washing”; with respect to internal functionality and with respect to intended use as a washing machine. The outer form of the machine, its color, the placement of various interaction devices etc in combination with internal functionality is what makes the machine a washing machine. There is an inherent expressional logic that defines the machine as we “see” it, a logic that is also basic to the way in which we use the machine. This is really a matter of aesthetics where the notions of form and expression are central with regards to systematic explanations.

Interaction design form can in this context be understood as the way in which a *design* relates function and interaction to each other, more specifically it concerns the logic of acts defining intended use of things and systems.

Central form elements in interaction design are connected with act presentation of temporal behaviour. An act is something we perform. The spatial “things” we design are somehow “instruments” we use to build these acts.

Let us consider a hammer. The hammer has its spatial form as merely a thing among other things. We can describe the typical form of a hammer to provide a logic that explains its form as merely a thing. But its form as the carpenter’s tool has more to do with its logic as the tool that we use to build the acts that defines its intended use as a hammer. We can measure the length of its handle and the weight of the hammerhead and understand that on basis of its use as the carpenter’s hammer. This logic is the form of the hammer as a tool. All this is more or less true about a piano as a music instrument. When we consider the aesthetics of the piano as an instrument it is clear that form is more than the spatial shape of that thing standing in a concert hall. It’s more about the way in which it works as an instrument for performing music; the logic that makes it understandable and usable as that specific instrument.

The things themselves are in some sense material, they build the acts that define them in use. Shaping use can be understood in terms of the logic that explains them as performing instruments. All this makes the foundations of interaction design very different from say graphics design and also makes sketching very inadequate as basic tool in dealing with the fundamentals of form in this context.

The logic of acts defining intended use is inherent in the design. It is what makes the guitar a guitar whereas we of course can use it as something else. The notion of interaction design form considered here puts the design in focus as the focal object of a rational constructive design process. But as soon as we actually use the designed thing, system etc it is more a matter of performance, i.e. it concerns the way in which *we* ourselves relate function and interaction to each other. It is important to keep the distinction between intended and actual use in mind, i.e. the difference between definition of things by design and definition of things by use.

THE ISSUE OF EXPRESSIONS

A concrete act of use is an expressional entity, a way of presenting something.

Expression, in the context of interaction design, refers to the way in which a design presents itself through the acts of use. Function and interaction meet somehow in the expressions of use; functionality resides in the expression of things in use. (Cf. [Hallnäs, Redström 2])

A basic aesthetical leitmotif, or foundational axiom, of interaction design could then be formulated in terms of the following slogan:

- usability resides in the expressions of acts that define use.

Within the design process this refers to defining acts of intended use; it concerns definitional expressions not expressions of actual use.

Computational technology gives us a very rich and expressive material to express “interaction” form. As we build computational things, digital products, we use programs to formalize interaction patterns and to more or less indirectly formulate fragments of a logic that builds the products as performing instruments. Consider for instance the difference in defining “photography” we find in the design of an analogue camera and a digital camera respectively. What a camera does is to take pictures – its function. The digital camera produces digital data; the picture taken is data ready for some program to work on. The picture taken with an analogue camera is film. It is not only material involved that is different, but the form of defining acts is also different. For the digital camera we use sensor technology and computational technology to see the picture we take in real time. As we look through the lens – or a dioptre – of the analogue camera we see the motive. With respect to taking pictures this is not mainly a difference in function, but a difference in form, i.e. a difference in logic of the cameras as instruments for performing basic acts of photography.

Aesthetics in this context concerns basic logical principles that relates to the way in which we *define* “interaction”. This also means that notions like “me”, “us”, “users”, “performance” etc., in this context, are logical variables and not phenomenon open for empirical studies.

An inherent difficulty here is to make the necessary distinctions between definitional matters of the design process and analytical matters of empirical studies. In a systematic design aesthetics, providing a logical foundation for design practice, form and expression refers to the form and expressions of definitions, i.e. to the way in which basic definitions relates function and interaction to each other and to the way in which basic definitions presents a design through intended acts of use.

Within the design process “use”, “users” etc are logical notions we define, where “intended use” is the focal notion that determines the design; the acts that define intended use simply refers to a logic of intended use that tell us what the thing, system etc is by definition. How we define these things and systems through actual use is a different matter. But the inherent logic of design expressions is still what links intended use with actual use.

If we introduce components of interaction design in the “basic course” we must, in addition to teaching the “laws” of spatial form and visual expressions, also introduce the aesthetics of act design in some form. This is still a matter of understanding the intrinsic relationships between abstract form and concrete expression, but within a different

context. It is also a shift in basic methodology; from design by drawing to design by act defining. To formulate a coherent foundation of such an act design methodology is a basic challenge for the aesthetics of interaction design.

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The aesthetics of Use

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ABSTRACT

The goal of paper is through a discussion of the aesthetic interface to sketch out a position between art and interaction theory in the intersection of interaction and artistic tradition that arise from the result in an aesthetic of use.

Author Keywords

Aesthetic HCI, transparency, somaesthetics, use of objects.

ACM Classification Keywords

H5.2. information interfaces and presentation (e.g., HCI) User Interfaces.

INTRODUCTION - THE "AESTHETIC TURN"

Today's entertainment, time pass and communications are very often mediated through computers of some sort. Computer games, Interactive Art, internet chat forums, online dating, mobile phones and much more. Experiences are created, received and experienced through the interaction with computers and computer interfaces.

On the same note, the paradigm for the computer interface has shifted from the tool paradigm of the usable, with its focus on function, efficiency and effectiveness, to a some what more fuzzy discussion of the users' experience of the interaction itself. The interface has become culturally and aesthetically informed – at least the use of the interface - and as such the interface also becomes subject of emotional, value and taste judgements.

This "aesthetic turn" in interface design gives way to – and requires - some considerations about what actually forms the experience and how to "apply" understanding of

aesthetics to the construction of interfaces. What is a qualitatively better interface? Could one imagine a fun and interesting time pass through online banking?

"ATTRACTIVE THINGS WORK BETTER"

The headline from a chapter in Donald Normans book "Emotional Design" [1] gives away one of the most commonly used misconceptions of aesthetics, namely the one that aesthetics promote only the attractive or beautiful. The object that gives an experience is not necessarily beautiful nor pleasing or accessible, but it is the object that mediates experience intended by the designer. This experience is experienced through the senses, hence the word's origin in Greek: aisthesis meaning "sensing", and as such perceived beyond moral values or practical use. Beauty is one sensation among many.

Of course, beauty has its advantages: We are inclined to spend more time with beautiful people, and more money on beautiful cars, even to buy beautiful computers, although they run a different operating system than the one we're used to. This generally positive attitude can be useful to designers designing an interface that requires more attention from the first-time user.

But in general, the understanding of aesthetics solely as beauty, and the application of aesthetics (i.e. "beauty") to design as an efficient way to ensure a good user experience is in fact a reminiscence of the old tool-paradigm in interface design, and its underlying understanding of the interface as something transparent, made for the user to look at and act through, towards the tasks goal. What has become beautiful is the programs skin, the program itself has not necessarily undergone major changes to accommodate its new, pleasing beauty. The beautiful becomes nothing but an beautifying ornament to the existing functions. Why spend time on fixing something that isn't broken?

BITTER GRAPES

The concept of aesthetics, as the philosophy of sensations, is knit tightly together with the History of Art, since both originate in 18th century Germany, building upon earlier attempts to describe the good and proper way to produce

works for appreciation. So, by entering the realm of aesthetics you also, somehow sideways, enter the history of Western art.

One of the earliest description of art is Pliny the Elders parable about a competition between the two painters Parrhasius and Zeuxis. [2] They competed to see who could create the most lifelike painting. Zeuxis presented a painting of grapes that were so perfectly painted that the birds were deceived hereby and flew down to eat them. Parrhasius presented a curtain, and when Zeuxis tried to see what it hid, he found himself deceived by a painted curtain.

Zeuxis lost the competition, since he only managed to fool the birds, whereas Parrhasius through his technical perfection was able to deceive even an fellow artist as Zeuxis. Parrhasius' painting was transparent to Zeuxis who saw a curtain and not a man-made representation of a curtain.

TRANSPARENCY AND OPACITY

In the days of early computing, the 1940ies and 1950ies, artists were heading another direction, away from the reign of naturalism, influenced by the New York art critic Clement Greenberg: "Emphasize the medium and its difficulties, and at once the purely plastic, the proper, values come to the fore." [3]. Abstract expressionism, or, Modernist Painting as it was labelled by Greenberg, was born. The artworks were often large painted canvasses, where the paint and the brushstrokes were anything but invisible. The emphasis was laid on the materials and what the artists had done to them, was the most important aspect of modernist painting.

In the context of modern interface design this little Art history can be used to point at the difference between the representation and the represented (e.g. looking at and looking "through"). You look at modernist paintings – there is nothing beyond the painting, the coloured paint and the brushstrokes. The painting does not tell any story (apart from the traces of the making of it) or representations of things you should know about in order to understand the picture. What you see is what you get.

The birds – and Zeuxis – saw the paintings and perceived their representations of natural objects as if they were in fact real. The birds they thought they saw real grapes, but they were tricked by the paintings perfect illusions to look through the representation to the represented, and so was Zeuxis in regard to the curtain. What you see is an illusion.

THE RED PILL

When we write letters using a word processor, we are, in fact, subject to the same illusionistic game that tricked Zeuxis and the birds. In the word processor we look at the letter as it will be, when it is printed (in a perfect world). We pull down menus in order to have more choices to pick from, but in fact all of it is an illusion. This is where "Morpheus" from the motion picture "The Matrix" enters

the scene with the red pill, that makes you see the Truth: What we really do, is to fiddle with a mouse until the computers monitor shows us what we want to see, and press keys on a keyboard, in order to issue commands to a program that translates it to "It looks as if You are writing a letter".

AESTHETIC INTERACTION

The vision for aesthetic interfaces is to give the users experiences that derive from the users' actual interaction with the artefact or computer-based product. Obviously, the success of the computer games industry in providing the good interface experience has played a major role as inspiration to the concept of the aesthetic interface, as well as interactive art has played its minor, but still important, part. Here it is shown as possible to design interfaces that actually give the users the sought for experiences when interacting with it. Both types of interfaces position the user in a relatively clear cut role, from where she can experiment and experience her way through.

These aesthetic systems do not follow the usual technological logic and rationale for efficient and effective interface design, by trying to be transparent, but put them selves in the way. The experience they provide is to solve their puzzle, as they turn the whole of the computer into an interface that at the same time *is* the puzzle and the means to solve it. In interactive artworks the traditional computer as such might even disappear, leaving an computerized environment to solve and experience through movement and handling of various objects. In short, both the computer game and the interactive artwork turn the computer into an aesthetic artefact, where you suddenly experience the interface as something that has an (meaningful) existence – or purpose –, and that your interaction is meaningful in regard to the context as a whole. Most important is that you actually do interact with something that in the context gives meaning to interact with, or, in the case of artworks, the meaning arises from your interaction.

The traditional (pre-aesthetic) conceptualisation of the computer interface in the office or industry and traditional art objects in the museum have in this connection more in common than meets the eye. The mental interaction is most important; for the interface, the handling of the mouse and the keyboard are convenient but to be used sparsely, and the art works are only to be looked at. They are both meant to be transparent, representing something beyond the users actual interaction towards the real world – e.g. letters in the case of word processors and nature in the case of painting.

The tragedy for interface design is that in many cases the insistence upon transparency as a design paradigm is a ill disguised excuse for focusing solely on the functionality, leaving the design, and visual and use experience, to coincidences.

The problem for the traditional approach in both departments is how to experience interactive artefacts as

aesthetical objects, but still continuing the illusion of respectively transparency and primateship of mental interaction and general denigration of use.

THE AESTHETICS OF USE

The experience of interactive artefacts goes mainly through the actual interaction with the artefact. This interaction is tactile – even if it only is moving the pointer, touching some kind of device is necessary. In contrary to previous design traditions and theoretical approaches to interface construction it is important to emphasise that the people known as users are in no way addicted to this or any interface, but are human beings of flesh and blood, and as such have interests and seek thrills and confirmation, but also are willing to accept a risk if it is clear what is at stake, which gains and losses we might counter.

Admittedly, employing the notion use in a discussion where the interaction with, or handling of, objects (i.e. use) is debated is, at best, redundant, but use describes exactly the contextually embedded and situated interaction with objects (real as virtual), for which the objects should be designed for.

Use is the central aesthetic category for aesthetic interfaces, since it is through the use that the meaning of the interface arises, and through use that the user makes her inputs to the interface. But contrary to previous aesthetic theory the theory for aesthetic interfaces must incorporate the corporeal experiences in order to accommodate the whole of the interaction with the interface, and thereby become *somaesthetics* as Richard Shusterman suggests. [4].

Central to the construction of an aesthetic interface is a thorough knowledge of the artistic means and an empathic understanding of the users position and wishes within the interface, but also the expanded aesthetics of interaction and use.

From this point, many experiments await the designer, to assure that the right qualities and values come to the fore through the interaction. That the work, as whole, is giving

users the right impression, and, thus, giving the user the right use experience.

CONCLUSION

Throughout history the creation of art has been based on an illusion of transparency, this illusion was made apparent through the introduction of abstract art, that left the viewer with only the traces of the production of the artwork.

Through the increased focus upon the aesthetic qualities of the interface and its ability to create experiences with the user, the idea of the interface as transparent is problematic, at best.

The only way to create interactive experiences is to achieve an aesthetic of use, where the knowledge of design from the aesthetic tradition expanded with the corporeal aesthetics of somaesthetics and combined with the knowledge of interactive media and an empathic understanding of users needs.

Without this knowledge, the designer will not have the ability to design an interesting and lasting experience for the user, but ends up with a washed out attempt to apply “good vibrations” to any interface, maybe even calling it aesthetics.

So, to cut things clear: the fancy glasses do not make the cheap wine taste better, it merely distracts you – before drinking – with the pleasant feeling of the fancy glasses. A feeling you, as glass designer, have been working hard to achieve.

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An Anthropological Notion of Performance for the Design of Physical Interfaces

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INTRODUCTION

Aesthetics in philosophy is a branch that examines the character of our experience of art and of the natural environment. The term was first introduced by Baumgarten in his *Reflections on Poetry* (1735) to indicate one of the two branches of the study of knowledge: “the study of sensory experience coupled with feeling, which he argued provided a different type of knowledge from the distinct, abstract ideas studied by logic.” (Audi 1995 [1], p. 12) The term is derived from the ancient Greek *aisthanomai*: to perceive. What could be contributions of aesthetic approaches to HCI? This work explores the application of one particular approach that originates from studies of “performance” to the design of physical interfaces.

The computer interface currently exploits a limited part of our expressive means. As an example, a widespread use of computers is to support slide presentations. In a variety of settings, slide presentations with common software and a projector result in similar arrangements in the physical environment. The computer interface, hardware set up, and the meeting room naturally support a single spatial arrangement, interaction, and presentation style. We communicate through the interface text and pictures, which is a limited portion of our potential ‘expressive means’. The computer set up is not designed to exploit, for example, embodied actions, physical artefacts, and spatial features. We can be expressive choosing ready made templates or artefacts: choosing a template for the presentation, or, turning to a different technology, choosing a specific coloured cover for the mobile phone, a logo for the display, and a variety of ring tones. The latter configurations are, however, not only expressive, but also oriented towards experience usage situations in a particular way. These choices of ready made artefacts reveal only partially the specificity of individuals that is, for example, revealed in handwriting. Again, in choosing a specific postcard, we are expressive, even if we did not take the photograph ourselves. The postcard, in turn, can carry a diversity of inscriptions, which, through their materiality and handwriting, contribute to communicate our individuality. In communicative acts we can be expressive also with our bodies, exploiting the physical environment. If instead of the postcard we send a photograph, we can be expressive

configuring our bodies and the scenography around them in a snap shot, or even in a short video using multimedia messaging. Returning to collocated social interaction, we can communicate with a great variety of modes (Finnegan 2002), only a small portion of which are supported by current computer interfaces. Scholars in semiotics are just now realising that modes can no longer be considered separate and that expressions must be studied as processes rather than products, incorporating the idea of practice. Their aim is to arrive at a framework that takes into account the multimodality and multimediality of contemporary communication (Kress and Van Leeuwen 2001 [6]). The idea of studying expressions as multimodal and multimedia processes, taking into account their emergence and contingency, has been implemented decades before in areas of anthropology that studied performance. This thesis shows how an anthropological notion of performance can be useful in designing physical interfaces.

PHYSICAL INTERFACES

Interpreting interfaces beyond the desktop computer, the keyboard and the mouse, has been the object of research in Human-Computer Interaction under a variety of programs. While commercial trends and part of the research point to ways of emulating the desktop computer, with some enhancements, in portable devices, another strand of research has sought ways to integrate computation into the physical environment. Research has resulted in a variety of new interface techniques and technologies, as well as applications of computing beyond the desktop. However, it laments the lack of field studies of these emerging interfaces, as, most of the time, prototypes are confined to laboratories or demo-settings in conferences. Taking seriously a design agenda of integrating interfaces into physical environment might mean questioning with the same seriousness our approaches and assumptions around interfaces. In particular, there might be possible or emerging roles for “physical interfaces” that are undermined by approaches and assumptions well suited to the desktop computer. Moreover, the mostly technological oriented research, until now, has revealed more about what is possible to implement, than how such interfaces would feature in real settings. How does research explore, and

what are possible and emergent roles for physical interfaces in real-life settings?

AN ANTHROPOLOGICAL NOTION OF PERFORMANCE

This research seeks to answer this question by means of a case study in a real setting, which features field trials of physical interfaces. The case shows the contribution to the design of physical interfaces of a perspective novel to HCI, coming from studies of performance in anthropology.

Following previous works in anthropology (e.g. Victor Turner, Richard Schechner, Eugenio Barba), performance can be taken to address:

Everyday life, the word performance can interest a variety of situations beyond theatrical performances and rituals.

Event and Processual character of action and interaction, Performance is about bringing something to completion that has an event character, an initiation and a consummation. It indicates an ephemeral and contingent process to particular socio-material-historical circumstances.

Expression and individuality as embodied in people's

through participant's interactions (cf. Acconci's Performative Architecture [7]).

Energy and consciousness. It implies an act of expression directed to others and, dissimilarly to behaviour that is not performance, more efforts in terms of energy, skill and consciousness (thinking) of the acts (Barba [2]).

Action and Experience, there is a simultaneousness of presence and representation; in Dewey's terms a structural relationship between "doing and undergoing" [2].

Expression and perception. Experience structures expression and expression structures experience. Expressions can contribute to perception and therefore to new insights, either in their act of creation for the "creator" or as embodied artefacts in their material and immaterial qualities for an "experiencer".

The relevance of this "performance perspective", addresses two neglected areas in current research that are increasingly relevant for physical interfaces. First, there has been a tendency in HCI to consider the environment as a pre-designed setting or to look at their historical evolution in longer time frames. In particular research has either

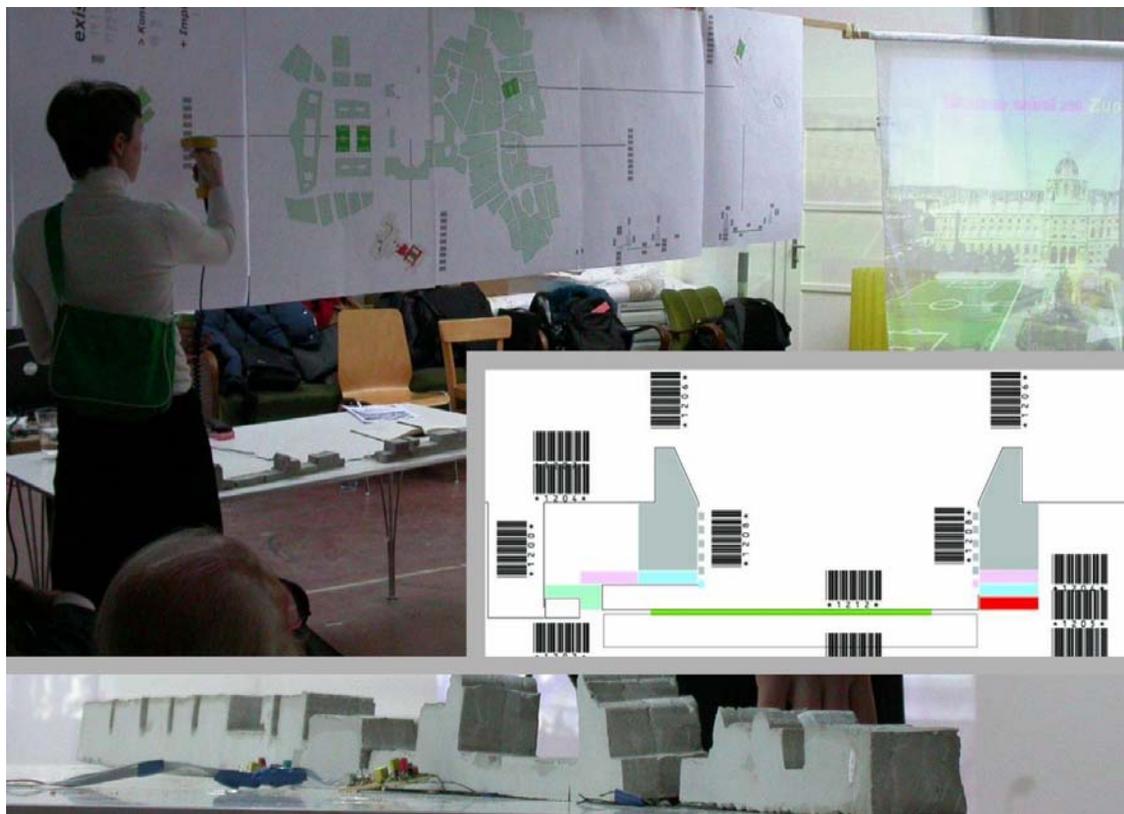


Figure 1: Scripting and configuring interactive artifacts, a physical model and a CAD drawing with integrated barcodes

actions and movements.

Space and artefacts. Performance may be considered in the creation of artefacts or architectures, especially in the ways these carry a performative potential that is unleashed

attended the micro organization of activities and artifacts looking at situated action or has considered the historical evolution of activities and technology. Performance points to the neglected middle ground including the event-like

character of activities and how actors re-arrange collections of artefacts and re-configure spaces. Current technology development in physical interfaces treats configurability as predominantly important during the design phase. A second neglected area is the way in which physical artefacts, populating an environment in a real setting, are affected by the introduction of physical interfaces. Moreover, this might include a role for practitioners (but not designers) to configure interactivity in artefacts to *express* or *experience* the specificity of the project they have at hand.

A CASE STUDY

The main case study presented as evidence involves the creation of a mixed media environment for the project based-learning of architecture students [1]. The environment had a variety of components that were the object of trials: physical inputs as sensors, RFID tags and barcode scanners to animate physical models and diagrams; media players on multiple projectors and a physical infrastructure including furniture were used to create and

Configurability. How can configurability be pursued beyond the design phase and what is its relevance and relation to space, artefacts and bodily movements?

We have found at least three kinds of evidence of performative interactions in the Atelier field trials:

Performative artefacts (Figure 1). Artefacts augmented with sensors and tags were “scripted”, associating images and sounds to different interactions. The artefact in these cases does not unleash its communicative potential by just being observed and scrutinised, but a participant must interact with it activating the playing of digital media. Interactive technology exploited the articulation in material qualities, spatiality (touch sensors in a solid section that becomes an interactive skyline) and affordances (turning the pages of a diary) rendering them more expressive. Artefacts acquire meaning through material qualities, their spatiality, and the way participants interact with them. This is evidence of how physical interfaces, supported performative uses of artefacts, moving beyond the simple tagging or tracking of



Figure 2: Staging and performing Mixed Objects, white models are electronically painted on different backgrounds

configure mixed spaces; a applications to paint with a real brush physical models projecting digital texture; computational support to record and visualise multimedia paths while visiting remote sites; tools to manage configurations of digital media in the environment and associations of physical inputs and digital outputs. The trials resulted in a variety of performative uses of technology (Jacucci and Wagner forthcoming [5]).

These premises and the particular implementations and interventions in this research lead us to analyse physical interfaces along four dimensions, for each of which the thesis answers a question. Physical Artefacts. How do physical interfaces relate to existing material artefacts and what are the properties of new artefacts that can be created? Space. In which ways can space be exploited with physical interfaces? Embodied Actions. What role can bodily movements play if augmented through physical interfaces?

an artefact.

Staging Spatial Narratives (Figure 3). Performance stresses how meaning is embodied in the careful and expressive arranging of elements in the space. The Students played with scale and immersiveness creating inhabitable spaces with multiple projections. In these cases the spatial configuration is not neutral but concurring to narrate the concept; it is a narrative use of the spatiality of projections. The bodily presence of spectators is carefully taken in considerations and in some cases spectators became participants contributing to the representation (becoming the audience of a stadium or passenger in a train). For example multiple projections are

Staging and performing Mixed Objects (Figure 2). Mixed are objects that have simultaneously physical and digital affordances. As for example an electronically painted

physical model with projected backgrounds. "Performance", in this case, refers to how these configurations can be seen as staging and performing mixed objects. These exist for a limited time; they are ephemeral, although they can be saved and reloaded (to some extent). As performances, they are recorded with pictures or through videos or they have to be performed again.

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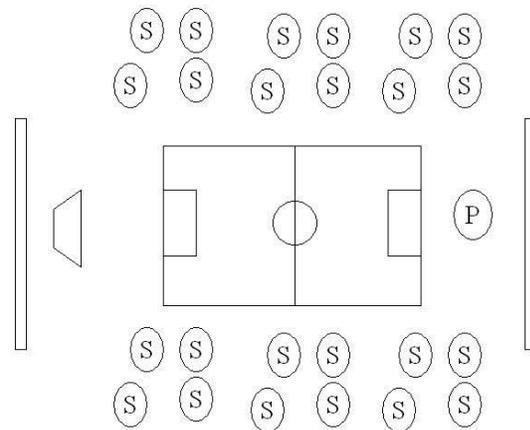


Figure 3 Bodily configurations in spatial narratives, (P) performers, (S) spectators, the spectators are part of the representation as in a loud stadium

An Experimental Aesthetics Approach to Evaluating Websites

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Abstract

This paper takes an experimental aesthetics approach to evaluating Website homepages. An experiment was conducted in which twelve homepages were evaluated by twelve subjects. The pages were ranked in terms of three collative variables; complexity, interestingness and pleasingness. The experiment used card sorting and self-reporting as research methods. The results indicate that the most pleasing homepages were neither the most or least complex or interesting. The results of the experiment show the relevance of Berlyne's [1] approach but also the need to extend the range of collative variables for understanding homepage preference in terms of accessibility, usability, engagability and beneficance.

1. Introduction

Experimental aesthetics is a scientific approach to understanding aesthetic experiences. Experimenters, including Berlyne, adapted the methods used by Fechner [2]. The most popular of these is the 'method of choice'. Here, subjects choose the most pleasing object from a selection presented to them by researchers. In addition, Fechner described the 'method of production', whereby subjects change the characteristics of an object to make it more pleasing. Finally, Fechner suggested the 'method of use', where subjects examine a work of art in the whole on the basis that it contains generic aesthetic elements.

Berlyne focused on the relationship between aesthetic pleasure and properties of works of art. He began from an information theory perspective in which works of art are

understood "as an assemblage of elements" that comprise of four information domains, shared between creator, object and viewer as;

- Semantic information;
- Expressive information;
- Cultural information and;
- Syntactic information.

Berlyne proposed that works of art contains a number of measurable properties that he called collative variables. Berlyne identified a number of these variables including ambiguity, novelty, familiarity and complexity. According to Berlyne, aesthetic pleasure corresponds to arousal induced by collative variables in accordance to Wundt's inverted U curve. Thus, increases in collative variables increases pleasure but this peaks and declines, suggesting that moderate arousal increments are the most pleasurable.

There have been some criticisms of Berlyne's work. Critics argue that he underplays individual differences and overplays the role of collative variables and arousal. Indeed, even within the experimental aesthetics tradition [3] experiments have shown the importance of ecological variables, like meaningfulness in determining aesthetic preference. This position is supported by the current research.

Lavie and Tractinsky, [4] argue about the "marginalization of the aesthetic dimension" in HCI studies. They also point out that although there are studies giving guidelines for usable and visually appealing Websites, they generally end up focusing on functionality and usability. However, their own work is indicative of an increasing interest in aesthetics in a traditionally science and engineering based discipline. Indeed, in the last few years, a number of studies on aesthetics in HCI have been produced (e.g. Lavie and Tractinsky, [4] Tractinsky, [7] Schenkman and Jonsson [6]).

Lavie and Tractinsky's [4] research of Websites concluded that users' perceptions have two main dimensions. Firstly there are perceptions of classical aesthetics that stress "orderly and clear design" and, secondly, there is an expressive aesthetic dimension that is linked to the "designer's creativity and originality". Schenkman and Jonsson's [6] study on preferences of Web pages concluded that beauty was the most important element in the overall judgments of web sites. The aim of this research was to test Berlyne's collative variables with Website homepages. The hypothesis of the study is that complexity correlates with pleasingness and interest in accordance to Berlyne's Wundt curve.

2. Method

2.1. Subjects

Twelve participants, between the ages 24 and 54 were recruited for the experiment. They were all graduates of either art and design, science and engineering or the humanities.

2.2. Stimuli

Twelve websites homepages were selected as stimuli. These were presented as colour screenshots on A4 white paper. The rationale for using paper screenshots was to enable subjects to view all twelve stimuli and thus make a comparison. The sites were not randomly selected but were chosen to give a range from "simple" to "complex" homepages. The websites were taken from Macromedia's 'site of the day' [5]. Unlike the stimuli used by Berlyne, the homepages included text and a range of shapes and colours. Unlike Web pages the stimuli were static.

2.3. Room conditions

The experiment was conducted by a researcher using a script and took place around a large table. The room was artificially lit and approximately 6 metres by 12 metres in size.

2.4. Procedure

Three sets of twelve screenshots were printed on white paper. Each homepage was assigned a letter of the alphabet and each set was randomized. Subjects completed a demographic questionnaire and were given a demonstration of card sorting and self-reporting using a deck of playing cards. Each subject was then asked to order a set of homepages from the simplest to the most complex on the table. Having ordered the homepages each subject was asked to describe the qualities of the least and most complex selections. The homepages were then removed and the selection tabulated on a record sheet. The record sheet noted the order in which the subject sorted the homepages from highest (e.g. most complex) to lowest (e.g. least complex). This procedure was repeated with subjects ordering the homepages in terms of interestingness and then pleasingness.

3. Results

The record sheets for each subject were then tabulated on the basis of highest to lowest position in the ordering of homepages. Scores were then assigned to each position from twelve (highest position) down to one (lowest position). Each of the twelve subject's scores was then tabulated so that each homepage had a cumulative score of each of three variables. The scores were then plotted onto graphs showing the relationships between variables. The self-reports were collated and analysed by counting and noting commonly used descriptors.

Interestingness – Pleasingness

Fig 1. Shows the relationship between interest and pleasingness. The results indicate an initial fall in interestingness as pleasingness increases. The least pleasing home page is not the least interesting one. Pleasingness then increases with interestingness until both peak and then pleasingness declines. The most pleasing home page is not the most interesting.

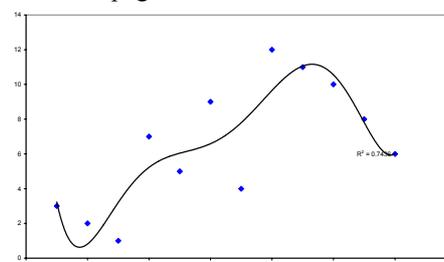


Fig 1. (Y axis = Interestingness and X axis = Pleasingness)

Interestingness – complexity

Fig 2. Shows the relationship between interestingness and complexity. The results indicate that there is an initial peak in interestingness as complexity increases. This reaches a high point and then there is a strong relationship of decreasing interestingness with increasing complexity.

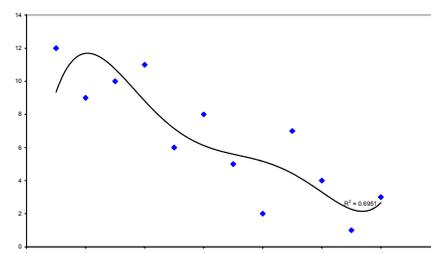


Fig 2. (Y axis = Interestingness and X axis = Complexity)

Pleasingness – complexity

Fig 3. Shows the relationship between pleasingness and complexity. The findings suggests that pleasingness and complexity increase in tandem until they peak and decrease together. However, both peak again as high levels of complexity are reached.

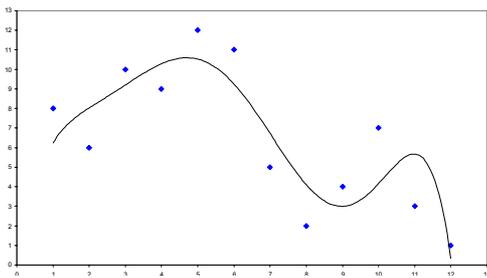


Fig 3. (Y axis = Pleasingness and X axis = Complexity)

Most Interesting Home Page

Fig 4. Shows the most interesting homepage (isabellafore.com). Table 1. Shows four descriptors used in self-reports of high interestingness scores.



Fig 4. Isabellafore.com homepage

- Appealing
- Original
- Intriguing
- Minimal

Table 1. High interestingness descriptors

Most Pleasing Home Page

Fig 5. Shows the most pleasing homepage (designyourownhome.com). Table 2. Shows four descriptors used in self-reports of high pleasingness scores.



Fig 5. Designyourownhome.com homepage

- Balanced
- Stylish
- Intriguing
- Restrained

Table 2. High pleasingness descriptors

Most Complex Home Page

Fig 6. Shows the most complex homepage (marumushi.com). Table 3. Shows four descriptors used in self-reports of high complexity scores.

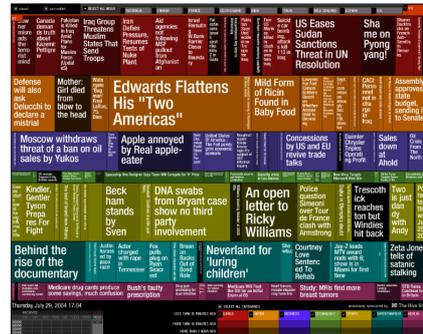


Fig 6. marumushi.com homepage

- Overpowering
- Intense
- Daunting
- Unordered

Table 3. High complexity descriptors

Least Interesting Home Page

Fig 7. Shows the least interesting homepage (nbcolympics.com). Table 4. Shows four descriptors used in self-reports of low interestingness scores.



Fig 7. nbcolympics.com homepage

- Unsurprising
- Establishment
- Expected
- Confusing

Table 4. Low interestingness descriptors

Least Pleasing Home Page

Fig 8 Shows the least pleasing homepage (marumushi.com). Table 5. Shows four descriptors used in self-reports of low pleasingness scores.

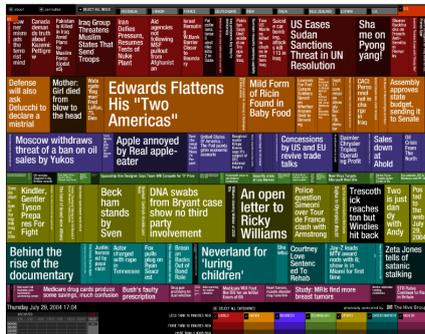


Fig 8. marumushi.com homepage

- Stressful
- Aggressive
- Complex
- Heavy

Table 5. Low pleasingness descriptors

Least Complex Home Page

Fig 9 Shows the least complex homepage (IsabellaFiore.com). Table 6. Shows four descriptors used in self-reports of low complexity scores.

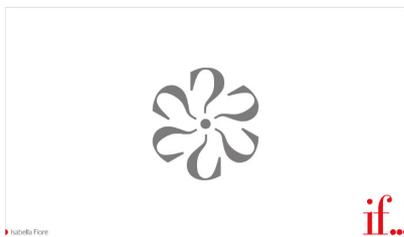


Fig 9. IsabellaFiore.com homepage

- Simple
- Unified
- Clean
- Powerful

Table 6. Low complexity descriptors

Conclusion

The current research supports the efficacy of an experimental aesthetics approach. There were a number of limitations in the study. Firstly static screenshots were used that may not reflect the diversity and interactivity of Website homepages. In order, to achieve this it might be useful to adopt a genre approach. This would provide a high level categorization with the possibility that different genres work on different levels of ecological and collative

variables. The combination of rich media, text and links suggest that people do not look at Web pages as static visual phenomena and that ecological variables (e.g. motivation, experience, and lifestyle) play a role in preference. If the experimental approach is extended to interactive experiences then it needs to be integrated into a holistic set of use qualities such as those proposed by Knight [8]. This identifies four qualities of the user experience:

- Accessibility
- Usability
- Engagability
- Beneffiance

It is likely that each of these qualities has its own aesthetic dimension and need to be balanced according to the product benefits. Future research will focus on eliciting collative and ecological variables to account for the four use qualities.

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Aesthetic and emotional evaluations of computer interfaces

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ABSTRACT

Even though aesthetic appeal and emotional impact are essential aspects in our interactions with information technology, aesthetic appraisals and emotional experiences have played a marginal role in HCI-related research. We are exploring the factors of visual quality that are important for user experience and developing better methods for measuring aesthetic evaluations and emotional responses. Our framework for the description of emotional states is based on the PAD emotion model [8].

Author Keywords

Aesthetics; emotion; user interface.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

There is a growing conviction that usability alone is not sufficient for ensuring user satisfaction, but such factors as beauty, learnability and tangibility are also important. It has also been proposed that usability is not orthogonal to these determinants and they correlate with usability [1,11]. For example, beauty judgments affect people's perceptions of apparent usability.

Even though aesthetic appeal and emotional impact are essential aspects in our interactions with information technology, evaluation of aesthetic preferences and emotional experiences have played a marginal role in HCI-related research. One reason is that aesthetic and emotional appraisals are difficult to measure; another reason is that aesthetic responses and evaluations are determined by several factors of which beauty appraisal is only one [6].

AESTHETIC EVALUATION OF COMPUTER INTERFACES

Experimentally oriented aesthetics has a quite long history [2]. Many of the previous studies are, however, problematic for several reasons: Often the stimuli have been poorly controlled, often undeveloped measures have been used. Our aim is to systematically explore the factors of visual quality that are important for user experience and to develop better methods for measuring aesthetic evaluations and emotional responses. The second aim is to develop psychological models that can explain the impact of emotional information on aesthetic evaluations of user interfaces.

Several techniques have been proposed as possible methods to evaluate aesthetic appeal of computer interfaces [6]. The various techniques can be divided into descriptive inventories, public preference evaluations and quantitative holistic techniques [7]. Descriptive inventories include formal aesthetic models; public preference evaluations are, often conducted using questionnaires; and quantitative holistic techniques are based, for example, on psychophysical methods.

Descriptive inventory-based approach includes both quantitative and qualitative methods of evaluating computer interfaces by analyzing and describing their components [7]. Implicit in this approach is the assumption that the aesthetic value of an interface can be explained in terms of the values of its components. Preference evaluation techniques are, in turn, based on the assumption that the aesthetic value of an interface can be most successfully assessed by clarifying an observer's individual preference of it. It is essential for this approach that the judgment is based on the interface as a whole. Both questionnaires and interviews can be used for gathering preference information. Quantitative holistic methodologies are based on both quantitative preference evaluations and interface feature lists. These methods typically apply multiple regression analysis to establish a mathematical relationship between components of the interface and people's preferences [7].

All these types of techniques have some methodological problems that can limit their usefulness [7]. It is, for example, not always clear what the preference ratings

indicate. They could represent either people's preferences for the interfaces or their evaluations of beauty of the interfaces. Beauty judgments are not the same thing as user preferences. When asked to assess their preference for various interfaces, people tend to judge the overall usability of those interfaces rather than inherent beauty [4,7].

OUR STUDIES

Our aim has been to combine psychological evaluation with the evaluation of formal properties of interfaces. We are exploring the factors of visual quality that are important for user experience and we are developing better methods for measuring aesthetic evaluations and emotional responses. Our framework for the description of emotional states is based on the PAD emotion model [8]. According to this model, the dimensions of valence (displeasure-pleasure), arousal (low-high), and dominance-submissiveness provide a good general description of human emotions. So far, we have investigated the effect of different visual factors, such as color, shape and texture, on aesthetic appraisals of web pages [4,5].

A glimpse at today's web sites shows a great variation in background colors and textures (ie surfaces that are structured from the pattern of repeated elements) that appear to have been chosen without much care. However, there is clear evidence that it is not unimportant which colors and textures are used. Numerous studies have shown that people prefer certain colors and geometrical figures over others, and colors and figures describe emotions and may even elicit a particular emotional state in the user (for a review, see [12]).

In one of our studies subjective preferences and emotional reactions to text/background color combinations, font type and word style were investigated in two experiments [4]. The participants' task was to rate each text along a ten-point scale for readability and pleasantness. In addition, the participants rated the valence, arousal and dominance of each stimulus using the Self-Assessment Manikin (SAM) affective rating system. Their task was to think of how the text makes them to feel when they rated it. The results suggested that one simple way to improve aesthetic appearance of graphical interfaces is to use pleasant text/background color combinations and font type. Personal differences, however, have to be taken into account.

In another study, the participants evaluated textures or plain, single-colored patterns using the SAM affective rating system [5]. Among the most important findings are the following: (1) Figurative textures seemed to elicit higher pleasantness and arousal ratings than abstract, non-figurative textures. (2) Some properties of textures such as mean grey value, symmetry and regularity contribute to the arousal ratings of these stimuli. (3) A pattern that lies on a background of figural elements may have an effect on people's emotional evaluations - the fact that it is only the background for a figure does not necessarily reduce its effect.

MODELING THE EFFECT OF AESTHETIC EVALUATIONS

It is probable that both cognitive and affective information processes contribute to aesthetic evaluations. Some stimulus properties provide primarily cognitive information. This information is used in constructing both mental models of the interaction with and representations of the user interface [9]. Such stimulus properties as texture and color may also provide affective information that can be represented as affective knowledge of the experience with the interface. How aesthetic preferences are based on these two types of information can be modeled in several ways. Possible theoretical approaches include associative network theories of affect and cognition [3] and multi-level theories of cognition-emotion relations [10]. These models can guide us toward better understanding of the key issues surrounding the role of aesthetics in HCI such as:

- the relationship between aesthetics and usability,
- the relationship between beauty appraisal and preference,
- the effect of affective experience on aesthetic appraisal, and
- the effect of tangibility on aesthetic appraisal.

CONCLUSIONS

Aesthetics and usability are not mutually exclusive phenomena, but aesthetics plays a great role in affecting interface usability. Our aim is to explore the main determinants of the aesthetic assessment of computer interfaces. The approach has several limitations, however. For example, aesthetic judgements are not static, as we have suggested here, but they are constantly changing because of the changing culture and habits. A real challenge is to develop methods that make it possible to explore the dynamic properties of aesthetic evaluations.

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Aesthetics of Interaction

– a pragmatist perspective

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ABSTRACT

It describes the characteristics of this perspective.

Author Keywords

Aesthetics, interaction.

ACM Classification Keywords

H5.m. Information interfaces and presentation

INTRODUCTION

This paper explores a specific theoretical perspective on aesthetics of interaction which is Shusterman's theory on Pragmatist Aesthetics. It develops from this theory a hypothesis that aesthetics of interaction is characterized by that it establishes changing relationships to materials, is interrelated with instrumentality, it must be understood in a historical and socio-cultural context, and finally that it explores the potential of both human body and mind. This position paper explores this hypothesis and discusses what can be characterized as exemplar interaction designs, if we adopt this hypothesis, and it starts a debate on what are the implications of such a perspective for the design approach we take.

PRAGMATIST AESTHETICS

In the following is described four characteristics of pragmatist aesthetics, as interpreted onto the domain of 'aesthetics of interaction'.

In a pragmatist perspective, "the work of esthetic art satisfies many ends. It serves life rather than prescribing a defined and limited mode of living. We are carried to a refreshed attitude toward the circumstances and exigencies of ordinary experience" (Dewey, as cited in Shusterman (XXX), p. 9.). Thus aesthetics of interaction is when the means of interaction establishes a new relationship to the materials that are manipulated

Second, in a pragmatist perspective, aesthetics and instrumentality are seen as highly interwoven. This makes the pragmatist perspective a useful starting point, if we want to understand how to design aesthetic experiences invoked by interactive technologies. This is in contrast to Kantian notions of disinterestedness..

Third, in a pragmatic perspective, aesthetic experience is tied to a historical and socio-cultural context. It can never just become a static quality of objects as seen in isolation, which is a perspective represented by more Kantian inspired approaches to aesthetics. What pleases by form is seen as properly aesthetic. Aesthetics is seen as properties of objects themselves rather than as established in a specific context, and related to instrumentality and everyday life.

Fourth, aesthetics of interaction addresses both mind and bodily experiences. Thus it challenges prevailing notions of interacting with technology, where our bodies are highly passive, mainly fingertips are used for pressing keyboards, and one arm is used to manipulate the mouse on a limited 2-dimensional surface.

AESTHETICS OF INTERACTION

Interpreting Shusterman's aesthetics onto interactive experiences, the defining characteristics of aesthetics of interaction is that it serves to establish new relationships to materials in a way that is instrumental for future use. This relationship must be new with respect to a historical and socio-cultural context. And the interaction invoked by the design must engage both our bodies and minds.

How then can we start to understand aesthetics of interaction of specific designs in this perspective. First, it can be argued that it can be analyzed from two perspectives. An analytical and an empirical, where the analytical evaluates the design intention: does the interaction establish new relationships to materials as seen in a histo-socio-cultural context? Does the means of interaction exploits both our body and mind. The empirical on the other hand explores the four dimensions from the users' perspective, in an empirical way. Through experiments, it is explored how the four characteristics are met by a specific design – in use.

These two analyses of course relates to eachother, but will also inevitably differ as users often do things designers never expected (ref)

Given this hypothesis, we can start analyzing specific designs

EXEMPLAR DESIGNS

In the following, two exemplar design concepts are explored in an analytic way, as there are no use experiences with them yet.

Playful interaction



The first case is a videoprototype depicting playful interaction with interactive spaces at a workplace (an architects' or designers' office). In this vision, digital documents can be positioned on walls and floors through throwing a ball at the wall or bouncing it into the floor. Going through the four characteristics described above, it can be argued that the interaction with the ball, rather than with a mouse, which is a well know interaction instrument in such a context, certainly serves to establish new relationships to the digital materials manipulated. They can now be positioned in the space in a playful and not very precise manner. The ball also brings new means of transferring materials between colleagues (throwing the ball to another person) than usually seen in this context. The ball interaction exploits well our human body, but perhaps does not equally well address our minds. It does very literally transfer documents in the ball's buffer to surfaces without exploiting more abstract and complex symbols. Exploring the aesthetic experience of the ball also serves an instrumental purpose as learning to use it directly enables the manipulation of documents which are part of daily practice in a design office.

Apple iPod

The second example is Apple's popular iPod, which enables easy, mobile playing of MP3 files. Although the iPod has an attractive design, and an appealing way of interacting with the music in terms of a 'spinning' wheel which allows scrolling in hierarchically and thematically ordered digital music.

Discussing the aesthetics of interaction offered by the iPod, if we adopt the above hypothesis makes it clear that it fails on some central aspects. On an analytical level, the interaction offered in the iPod does not serve to establish new relationship to music. It makes (digital) music more mobile, but in a historical and cultural context, this is not a new phenomenon. Perhaps the user-made playlists is the most important feature in this direction, as the user becomes more of a director of the contents that is listened to. The fact that the iPod is highly mobile does allow us to move in more free ways with our bodies, but it is not exploited with respect to interacting with the music itself. Selecting music by dancing according to a specific genre would be a more rich bodily experience with respect to interacting with music.

CONCLUSION

This position paper has proposed a theoretical basis for aesthetics of interaction and derived a hypothesis for what this theoretical basis implies for the aesthetics of interaction with interactive technology. It has analyzed two design concepts in terms of this hypothesis in order to investigate how these designs meet the criteria for aesthetics of interaction in this perspective.

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Material Matters

What Can HCI Learn From Aesthetics?

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ABSTRACT

Position statement and discussion paper for NordiCHI W5: Aesthetic Approaches to HCI. The paper argues for an aesthetic perspective on HCI that goes beyond usability and the pleasing or beautiful towards a focus on the digital material and its expressive potential. Digital art traditions and their relation to the concept of materiality are discussed, and a final argument about humour is launched.

Author Keywords

Materialism, digital art, software art, metaphor

What can aesthetics do for HCI? Several have argued that an aesthetic perspective can help to make the interface more pleasing and that an aesthetic pleasing or beautiful interface is not only more pleasing to use but also more user-friendly [Tractinsky]. Some currently argue for more emotional and experience generating interfaces [Norman, Shedroff] or interfaces that take notice of cultural differences. While all these trends are interesting, I believe that HCI will need to look into contemporary art in general and contemporary digital art in particular in order to discuss and discover the potential of aesthetics for HCI. This I believe is the case, even though much digital art go against common dogmas of HCI such as transparency and usability.

Contemporary art is generally speaking not concerned with the pleasing or even the beautiful, nor is it concerned with expressing well-defined emotions or experiences. Even though there are attempts to beautify the computer within the broad digital art and design scene (e.g. fractals, skins, screen savers), most significant parts of the digital art scene are investigating the material of the computer; its interfaces, structures, codes, context, sounds and material appearance.

Even though digital art and HCI basically work with the same material, two opposing views on the aesthetics seem to be directing the interests. There has been a strong belief in HCI that the computer should not get in the way, but that the interface should be invisible. In aesthetic terms this could be described as realism, though aesthetic realism spans from a belief that it is in fact possible to depict the world correctly so that one can see through the aesthetic representation – to a more media-realistic notion that representations are real, are affected by and have effect on reality. The former naïve realism governs large parts of the rhetoric around popular culture, technology and media and thus also the parts of HCI that aim to make invisible interfaces and computers. In the latter media-realistic notion, representation and the interface is not, and should not be, invisible, but an actor in the mesh of modern reality. This media-realistic notion that has some bearing within HCI [Kyng] is also relevant as a perspective on modern art, especially art that aims at a broader political and cultural context [Bourriaud] or art that uses other media as material in the tradition from pop-art to current sampling and remixes [Manovich]. Still, a strong tendency in modern art has been to investigate its own material and formal properties [Greenberg] resulting in an opaque representation. However the opaque high-modernist position is increasingly negotiated with the above mentioned media-realism, which both contains an investigation of the material and formal properties of its media, and uses this to make a reflection and representation of modern mediated reality. As several media theorists from McLuhan and onwards has pointed out, we live in a reality which is saturated with media and where no single medium is hegemonic, but where all media remediate other media and influence each other in a media environment. With the computer as a meta- or multi-medium that contains and combines earlier media, this development is highly intensified [Bolter & Grusin, Manovich].

Art traditions as well as ground-breaking works within popular culture have been driven by an innovative investigation of its material – from the stone in sculpturing (Rodin) over paint and canvas to the electric guitar and the recording studio in rock music (Hendrix, Beatles). Similarly, digital art has led a continuing investigation into the material of the computer. Early computer art of the 1960's such as the work of Frieder Nake and A. Michael Noll was

discover and rediscover, as the above quick outline of digital art indicates, then how can we describe art's relationship with its material? In a Marxian dialectic materialism – e.g. as developed by Walter Benjamin – art needs to investigate critically into its production process in order not to become pure phantasmagoria [Benjamin – e.g. "Der Autor als Produzent, II.2, 683-701]. However, this does not mean that art with the right tendency (to use Benjamin's term) has to become social(ist) realism, which in fact was often a naïve realism. Any material or the process of manufacturing may not be interesting in itself, but the way the material becomes meaningful, significant, and the way it is turned into politics, culture and aesthetics are the interesting pivotal points for art.

Digital artists have sought the potential meaning of the material turning it into, what N. Katherine Hayles has termed material metaphors [Hayles]. That is, contemporary software artists are investigating the cultural, political, aesthetic meaning of code, of the interface, of the historic hardware, of the many facets and layers of software. As Hayles writes about the book as a material metaphor and how this is investigated in artists' books and contemporary literature: "To change the physical form of the artifact is not merely to change the act of reading (...) but profoundly to transform the metaphoric network structuring the relation of word to world." [Hayles, 23]. This of course has implications for the intimate relation between user and machine, but also for the way we in general, cultural and ideological terms see and use computers, e.g. as either neutral tools or potential actors of change and/or suppression. From materialistic aesthetics (e.g. Benjamin), it is evident, that changes in the way we handle representation and aesthetic artefacts is dialectically related to changes in society and culture. Good examples of this is of course the ongoing debates on Open Source, software patents, alternative copyright, etc. Debates that occupy the digital art community and has been promoted by the Ars Electronica Festival through its prizes, conferences and publications, and has also been on the agenda on various other events (Read_me, Transmediale...).

Material matters – this is basically what HCI should learn from aesthetics. Of course it is not a simple task to learn from anti-HCI net.art or strange experiments with software art, when the purpose is to build functional interfaces. Still, the only way the interface can become expressive or an experience, as suggested by experience design, is by getting in the way, by containing elements of surprise and even by deconstructing the sheer and obvious functionality to some extent. HCI should develop beyond seeing the interface as a transparent medium that can relentlessly carry a message (either of a work domain, a learning experience or an expression) in order to begin seeing the interface and the computer as material with expressive power in its own right. Furthermore, as pointed out by HCI theorists [Bardram & Bertelsen] and evident from numerous examples, good software should not be restricted to the functionality, that the designer envisioned, but should include the

potential for further development by the users. In this sense, good software is not software that limits the user to the designed uses, but software that gives the user a framework for an independent and sovereign work practice and for further development beyond the designed uses. In order to obtain this, good software should, like good art, deal explicitly with its material; turn it into material metaphors that informs the user of the workings behind the screen, instead of using metaphors to screen off the machine and its materiality.

We need to get away from de-materialising the computer, from disguising it as something else. Both in theoretical and practical work, this does not lead to understanding of the computer's potential. Instead digital art can help us to re-materialize the computer, and to see the many ways the material of the computer can be investigated.

No Fun – closing remarks

Humour is an indispensable part of most communicational situations, whether they are personal or mediated. Most personal relations evolve through humour, business and office culture also consists of humour. Besides radio, TV and even advertising uses humour as an important ingredient of the communication.

The computer is also a medium for humour, e.g. the many jokes circulated by email, humour-pages on the web etc. Programmers and software developers also seem to have a well-developed sense of humour, judged by mailing lists, news groups etc. Still very little of this humour makes its way into mainstream software and interfaces. And if it does, it is often in the extreme margins, such as easter eggs that only true connoisseurs discover, or it is hidden in the source code [<http://www.eeggs.com/>]. In fact, mainstream software such as operating systems, office software and internet software are amazingly deprived of any sense of humour, unless one thinks that Microsoft's wizards are funny.

Why is this? Humour is important! It keeps up the spirit while working with dreary systems. Irony, humour, wit has the potential to make us stand machines and their simple denotative communication, but it can also be used to make the communicational situation more complex and rich. When a message is humoristic, the whole situation of the communication is drawn in and demonstrated, the message is staged, and the setting is revealed. Think of the court jester or TV satire. In this way, the humoristic message puts more trust in the competence of the user; humour can be understood on more than one level and needs competences to be understood. Of course the risk is that the message fails, and the user misinterprets the communication. On the other hand, who does not feel insulted by the way one is getting addressed by the Microsoft Office Assistant? Especially when it fails to address one's needs but keeps insisting in a friendly tone, that one wants to do something else.

Good humour helps to reveal the underlying foundations, the material beyond the software. And as is evident from email and internet culture, computer games and software art, as well as the broad cultural scene, people like humour, also on their computer.

While in mainstream software, humour is absent, software art is filled with humour. The humorous moment is often when the representation is deconstructed, when alternative uses of black-boxed functionality occur, when the dogmas of mainstream software is parodied or when all functionality eclipses in a beautiful crash [see e.g. here: <http://www.runme.org/keywords/+ironic/>]. In order to make engaging, thought-provoking, experience-generating or simply bearable software, we simply need more fun.

Of course it might not be fitting to use humour in the same way everywhere. And the suggested materialism should probably be applied differently in personal software used for cultural uses than in important control systems. However, the suggested materialism is important in all domains, not only in cultural or entertainment-oriented interfaces. When flying a plane, steering a ship, or controlling a nuclear plant, one needs interfaces that are not too transparent so that one can actually understand the interface's inner working or perhaps judge its mal-functioning if a critical situation should occur. One needs interfaces that are not too seducing in order to remember the machine behind the representation. Even in critical situations, it is in fact important that the interface gets in the way in certain ways [Andersen, Bertelsen & Pold].

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What is Aesthetics anyway? Investigating the use of the design principles

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ABSTRACT

This article presents the first results of an experiment on aesthetics applied to Virtual Learning Environments (VLEs). It focused on users' perception of the best screen layout developed using five design principles.

The study was based on empirical work conducted by [1], who identified 11 distinctive laws that represent the major aspects of Gestalt theory knowledge about visual form, which seems to contain the most relevant aspects for computer screen design, and [4] who proposed 14 aesthetic measures for graphic displays.

It also considered the technique of dynamic symmetry [2] based on the use of golden section and root rectangles that shows that only the dynamic rectangles can form a pattern where only certain rectangles of the same theme co-exists.

The present research work aims to ascertain whether the use of design principles can influence the users' perception of aesthetics of computer interfaces such as VLEs. It proposes the use of five design principles, based on [1], [2] and [4] for designing a VLE. An experimental study was conducted with 279 participants to evaluate the importance of the design principles as a determinant of aesthetics.

Author Keywords

Aesthetics, Design Principles, VLE.

INTRODUCTION

The aesthetics of design describes the characteristics of design that are responsible for the appearance and perception of a design artefact and can have a major impact on users' emotions and mental representation. Aesthetics is also probably related to human's appreciation of computer systems.

A recent book 'Emotional Design – Why we love (or hate) everyday things' [5], gives a new perspective on products based on affective design, emphasising their aesthetics and pleasure of use.

The studies conducted by [5] and colleagues suggest that emotion is a human attribute that results from three different levels of the brain: visceral, behavioural and reflective. From these studies he [5] devised the theory of

three levels of emotional design: visceral, behavioural and reflective.

- visceral design is the first level, what nature does. It is concerned with appearance and it doesn't depend on cultural aspects.
- behavioural design relates to the brain processes and control everyday behaviour. It deals with pleasure and effectiveness of use.
- reflective design is the highest level. It considers the message, meaning of the product and is culturally dependent.

These three dimensions are interrelated in any design and, despite being so different, there is no design without all the three. Their components interweave emotion and cognition. The emotional side of the design may be more critical to a product's success than its practical elements.

This theory can also be applied to computer interfaces, especially to VLEs, where the person may need additional motivation to be fully engaged in a distance learning course.

In the light of recent studies on aesthetics [1] and [2], the use of design principles to achieve usability [4] as well as the emotion design theory [5] and the findings reported in [3] and [6], this research has identified strong support for the hypotheses that aesthetically pleasing interfaces have a positive effect on users' satisfaction and pleasure of use.

RESEARCH APPROACH

In order to achieve the goal of the research this it has been necessary to identify:

- which design principles are relevant for computer interface aesthetics;
- how aesthetics impacts on the user's perception of the interface;
- what graphical aspects can influence user satisfaction, engagement and enjoyment.

A pilot experiment with 5 participants was performed in a controlled environment to check, improve and tune the main experiment.

Finally, the findings on this experiment would be the bases of a model to assess the importance of aesthetics in the context of VLEs. It will also be used, in a second stage, to verify the correlation of aesthetics and perceived usability based on the research done by [3] and [6].

RELATED WORK

Aesthetics of layout composition

Since the early twentieth century, the principles of visual communication developed by Gestalt psychologists have been discussed and re-emphasized. Nowadays, their importance and relevance to user interface design is more widely accepted and understood. Based on these principles, [4] have developed fourteen aesthetic measures (balance, equilibrium, symmetry, sequence, cohesion, unity, proportion, simplicity, density, regularity, homogeneity, rhythm, order and complexity) for assessing graphic displays completeness. Their empirical studies have suggested that these measures may help gain users' attention and build their confidence in using computer systems.

In the present work, these aesthetic measures have been combined with relevant design principles that are most accepted by the designers' community and widely used for the development of their practical work. The investigation has resulted in five design principles (unity, proportion, homogeneity, balance and rhythm) that seem to suit the particular needs of a screen layout of a computer interface for Virtual Learning Environments.

Unity refers to the extent to which a group of visual elements are perceived as all part of one single piece. Proportion is defined as the comparative relationship between the dimensions of the screen components. Homogeneity is a measure of how evenly the objects are distributed throughout the screen. Balance can be defined as the distribution of optical weight in a picture. Rhythm refers to regular patterns of change in the elements.

STUDY DESIGN

Study Design

This experiment's goal was to evaluate the importance that the five proposed design principles had on VLE's perceived aesthetics. It was done by presenting five slides, with two screen layouts, one showing the principle being well applied and the other, badly applied. The participant had to choose the screen layout (screen A or B) that he or she perceived as having the best organization of the elements.

A pilot study was conducted in a single day with five participants, one at a time, to ensure that the program would function correctly and could collect their choice on the screen layout. The result of the pilot study ensured that the program was working well and the desired data were being collected in a satisfactory way.

Participants

The main experiment involved 279 participants enrolled and working at Higher Education Institution in Brazil (CEFET-PR) and Siemens-Brazil, divided in 7 groups as follow:

- undergraduate students from Design course;
- undergraduate students from Computer Science course;
- undergraduate students from Engineering courses;
- graduate students from a MSc course on Technology and Innovation;
- lecturers of various subjects;
- members of staff;
- employees of Siemens-Brazil that were involved with their own Virtual Learning Environment.

Material

In order to evaluate the screen layouts which simulated a VLE, a software application using Authorware, authoring software from Macromedia, Inc., has been developed. This was necessary because Authorware is prone to deal with images and text, allowing programming at a high level and offering accessible maintenance by a non-expert user of computer programming languages. The Authorware suite presents an interactive method of programming, using flowchart, icons and windows (oriented to objects as well as to events).

Each principle was presented on an individual slide (for example see Figure 1) in the following way:

- Slide 1: showed two different screen layouts using the design principle of unity;
- Slide 2: showed two different screen layouts using the design principle of proportion;
- Slide 3: showed two different screen layouts using the design principle of homogeneity;
- Slide 4: showed two different screen layouts using the design principle of balance;
- Slide 5: showed two different screen layouts using the design principle of rhythm.

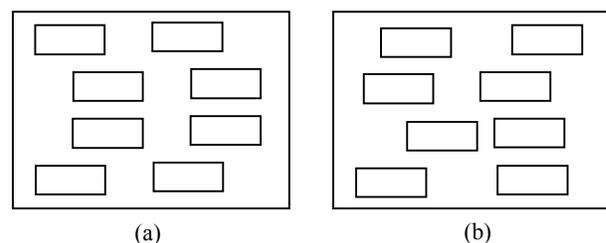


Figure 1 – Comparison of good and bad screen rhythm: (a) rhythmic screen; (b) disorganized screen.

Method

Each participant received individual spoken information and instructions about the study in which they were about to participate. After that, they filled in the consent form (in Portuguese, their native language, and English, as required by the departmental Ethical Committee) and then were guided to the computer to start the experiment.

The instructions for the participants were also presented on individual screens during the experiment, orientating them to what they would be seeing and how to evaluate it.

The participants were presented with five slides that encompass five design principles derived from [4]. Each slide showed two screen layouts representing one of the principles, where one followed the principles and the other did not. Participants were instructed to choose the one they would prefer (screen A which followed the principle or screen B that violated it).

They could spend as much time as they wanted to evaluate each slide and only when they clicked on the choice button (choosing screen A or B) would the program allow them to move the next one, registering the data in a separate file (txt). However, they could not return to the previous screen as this would cause problems in recording and interpreting the data acquired.

Results

The results showed that the use of design principles seemed to be an important factor in achieving pleasing computer environments, influencing the users' perception of the interface.

The analyses on the users' perception show that all groups appreciated better the screen layout that applied the design principles than the ones that did not. The example of the groups' average values of the design principles is illustrated in Figure 2.

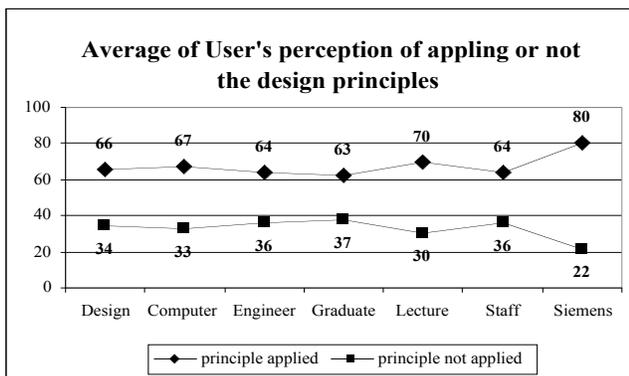


Figure 2. Average of the groups on perception of the design principles.

Figure 3 illustrates the users' preference for the using the design principle for the screen layout (all) and violating it (none).

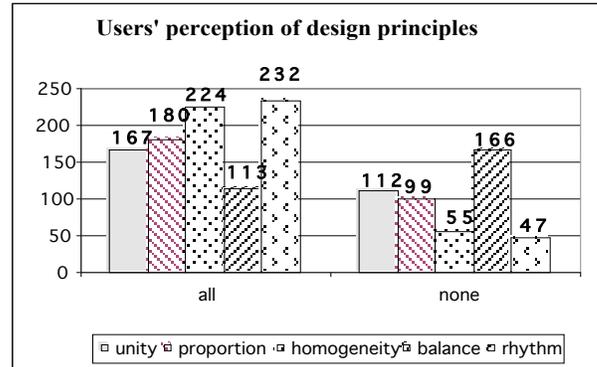


Figure 3. Perception of the design principles.

Unity and rhythm seemed to be the most important principles, followed by proportion and homogeneity; balance seemed to be the less important principle.

The statistical analyses among the categories show a high correlation on users' perception of the best screen layout between groups. The correlation between Design and Computer Science students, Engineering and Graduation students and Lectures and Staff were 0.92; 0.93 0.90, respectively.

CONCLUSIONS

This experiment has allowed the identification of the most important design principles that the interface designer needs to be taken into account when developing a computer interface such as a VLE.

The correlation analyses suggest that the participants perceived them using the visceral level of design which is responsible for the appearance of the layouts and does not depend on cultural aspects. It corroborates the theory developed by [4].

It also gave feedback on how to develop the screen layouts for the following experiment that intended to evaluate the relation between aesthetic aspects of the interface and its perceived usability. This second experiment, involving the same 279 participants, will be reported elsewhere.

ACKNOWLEDGMENTS

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Searching for the Aesthetic of Everyday Technology

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ABSTRACT

In the transition from an industrial to an information society we will require and get new forms of aesthetics of everyday technologies. For example, in contrast to analog technologies and haptic interaction, sensorial modalities could provide richer and subtler forms of interaction. In this position paper, and in contrast to this development, will I mainly talk about the aesthetic that could be found in the everydayness that people live in today, in their homes, well, in all these places that has been decorated based on who is actually living there and what they want to express about themselves.

Author Keywords

Everyday technology, aesthetics, field observations.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

The background of this project was born during an academic course in the spring of 1998. A first common project was a design of conceptual ideas that we did choose to call "Architecture and Ambient Media". This later project resulted in a couple of studies of inter-family communication, for example the ComeHome apartment [3], yet another project was the 6th Sense presence lamp [4]. Among the most central questions was:

- How should a product, within the context of the home, be designed that could create a more abstract communication between family members living apart?
- Analyzing this question, some more specific questions arrived that interested us:

- Which are peoples needs for communication (with whom do people communicate, how do they do it and why do they do it)?
- How do people use technology in their homes and what technology do they use and what do they think and feel about it?
- How do people act and what they do when they leave home and arrive at home?

But most fundamental in this discussion is the concept of the "home". For many of us is the dwelling primarily meant to support the activity "to live". However, we are now experiencing a major change in our way of living in the transition from an industrial society to an information society. Our hypothesis is that the dwelling of the information society has to be designed in a radically new way. Our key argument is that we will spend more time in our homes where we will also accomplish a wider range of activities [1, 2] which, in combination with the technology push, will lead to an extended need for communication facilities. The motivation for acquiring some technology in domestic environments could hence be derived from the dual purpose of fulfilling both social and professional needs.

In the rest of my position paper I will mainly focus upon our findings from studying this broader issue, i.e. what does the home represent? what kind of artifacts does really make a home to your home? how do keep links between family members alive?

GETTING REAL WORLD AESTICHS

During the "Architecture and Ambient Media" project a couple of observations were undertaken in ten different households. These families were selected representing different ages, social situations and type of dwelling, such as:

- a married wife with young children (4 and 6 years old), living in a rented apartment in Stockholm
- an unmarried woman living together with her boyfriend in a flat in Stockholm,
- a retired woman living in a one family house in a suburb of Stockholm,

- a teenage boy living at home in a flat in Stockholm.

The structure of the observations was divided into two parts, a walk-through in each home followed by an interview. We tried to get a first grip on how they managed their lives at home and what kind of style and things that was dominant in their homes.

A series of probes (often connected to a specific question) was asked to engage the participant to discuss issues not mentioned or only slightly disclosed earlier. E.g. "You have mentioned that... Why? What does it mean for you?". As the tour went along, we hence asked questions about the different things and furniture that we passed. Questions like: "What is this?", "You did you get it from?", "What does this thing mean to you?", "Could you tell me about this rocking chair?", and so on. These focused on what things people have in their homes today, and how they use them.

The persons that participated were, among other things, of different ages, different social status and lived in different kinds of houses. Therefore, naturally, their use of everyday technology and their communication with other persons were very different. In general the interviewed had a lot of technology in their homes, and they used technology in all sorts of activities throughout the whole day. They woke up by their morning bell, they used technical devices to cook their breakfast, they listened to radio, watched TV, listened to music, washed their clothes etc. supported by everyday technology.

We noticed many interesting differences between older and younger people in their relation to the technology. The older user meant that the machines function well as long as you do as they like and seemed satisfied with that. Meanwhile the younger user meant that the technology should work in the way you want them to work, and that you shouldn't have operate them in a special way.

Several times we were told that: "you continuously encounter with things that don't work well", "something is done to work in a special way and is meant to support you, but all goes wrong, sort or doesn't work well. If they had done in this or that way it should have been much better." This particular woman meant that she could accept some difficulties with the technology and had not reflected over that it could work better. An interesting thing is that several people that we meet put some of their technology in some kind of cupboards to hide it. The Stereo and video was hidden in a couple of the families' homes and in one family they even put the TV into the cupboard when it was not in use!

ON THE SEARCH FOR EVERYDAY AESTHETICS

With only a few exceptions the things that people felt most passionate about was things that carried a personal memory, like pictures or gifts. We all have our own experiences of postcards and pictures hanging on refrigerators and mirrors

in our homes. This common artifacts exhibit often a link between individuals, as in this example:

"I use the mirror to place my most important pictures and postcards .. then when I use the mirror we come [for a moment] together again .. I would like to be [often] positive reminded of these person"

But the rest of the stuff that homes are filled with, what relations do we and other people have to these things? The observations showed us that all families have furnished and decorated their home with things and furniture that not only have a practical function. Many things and furniture were placed there because they reminded them of a relative, or a situation in the family member's previous life. As one woman described it:

"When you where visiting grandma' you always sat in the rocking chair, she had several. It comes naturally to me to think of her when I sit in this rocking chair."

However, not only objects were represented or used in this sense. One man addressed an activity to the function of relationship maintainer or reminder. He said:

"My mother likes to cook, and so do I, so eventually when I cook, I might find myself thinking, we are probably doing the same thing now, my mother and I... [...]. When I was a kid I always stood on a chair next to the stove and cooked lingonberry jam the same way mothers in my family had done for over three hundred years. And in that moment I felt connected to all the mothers..."

One man claimed that the knowledge of the history of an object is important for the way he looked at the object. He said this about a table:

"I have learned to like it. I wouldn't have bought it, not even taken it for free, if it didn't mean something to me. The quality of this table lies in the knowledge of it belonging to my grandparents"

We also found that the use of lights seemed to follow a common pattern which was very similar between different families. Normally, you switch off lights when you leave home, but as we found out, this is not always the case. In one case, we were told that if they just went away temporarily they usually kept the lights on to show that they where in the neighborhood. Similarly, when people entered their home they walk around the apartment to light up the place as an indicator that they are home. In this way was lights conceived to be differently compared to other more passive objects. One man told us that:

"When I want .. or need .. to read I usally do that in our bedroom. In there [the bedroom] have I put my grandfather's old lamp. That light and the colors from the lamp remind about when I was child and he used to read for me in the evenings .. but its also tell the rest of the house that I prefer to undisturbed in my reading"

As a second step in the observations, a partial scenario technique was used that we refer to as "Situation Scenarios". Before we started the observations, we had prepared a number of plausible scenarios were intended to act as carriers of momentary situations, where the dynamics lie in the presence of other people, activities or media. We then asked the participants to act out these scenarios in their own homes. However this step is beyond the scope of this position paper.



Figure 1: Objects with Personal Memories

DISCUSSION

Of course, when we look around, many new domestic technologies fetch inspiration from modern trends and fiction. The artifacts of tomorrow will clearly manifest

multiple characters, and use combinations of fundamental geometric and organic forms sprung from nature and technology.

However, our major finding from this study is an alternative design approach where new functions are integrated into temporary objects, instead of inventing completely new products. A design rationale that introduces new types of technologies and new styles of interaction into existing everyday objects. In this way, we hope to create a bi-leveled understanding of our new technology by re-use objects that are known and have a basic functionality that we already know. The interaction and rendering of feedback bridges the gulf of distance between the machine and the human. From being outside to feeling included, from isolation to the feeling of company, from coldness to fundamental warmth and human embodiment.

Our hypothesis is that adaptively is the core key. We believe that if we support adaptively, we could support the development of a new interaction model.

Our idea is to provide a basic language that is very easy to understand, and at the same time make it possible to develop a new interaction language.

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