Visualizing the Vague: Invisible Computers in Contemporary Design

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Figure 1
This internet fridge from LG Electronic has a computer integrated in the front door. Except from internet surfing and usual software, the computer can also be used to leave messages between family members, and for recipes. But it does not keep track of the food and order it home as one would imagine.

Introduction

Design is a powerful tool in getting us to accept new ideas and things. In the past, this tool has been used to introduce new products and technologies as safe, familiar, and even invisible. But design also can be used in a critical or subversive way that challenges the prevailing norm. Because product design often operates within tight economic parameters, there have been few opportunities for designers to use their skills for critical projects.

During the last decade, the concept that computers should be "invisible" has influenced much IT development and research. But technology as such, and computers in particular, are too problematic to be hidden away. Instead of hiding computer technology, we should use the power of design to visualize and express the complex issues it raises.

This paper will outline the background behind the concept of an "invisible computer," as well as present some historical references in connection with the introduction of new technology. The idea of hiding something problematic will be discussed, drawing on ideas from psychology, design theory, and sociology. The idea of double invisibility from feminist theory also will be used as a tool to criticize invisible computers and to point out other available options.

From Radio Piano to Internet Fridge

When radio was new and people were reluctant to recognize the benefits of this new technology, its developers did a lot of creative thinking to find ways to convince people to buy it. Radios were advertised as healthy, fun, and educational. "Radio teas" were advocated as the new and fashionable way of meeting friends and family. But radio programs were scarce, and the radios themselves where bulky and difficult to use. To make the product more socially acceptable, the radio was made invisible; that is, it was concealed inside another well-known and traditional fixture in the home. The "radio piano" was a piano case with a radio hidden inside its case. A loudspeaker was integrated into the body so, in order to listen to the radio, the top of the piano had to be opened. In the evening, the family would gather around the piano, and listen to an enlightening or entertaining program.[1] This presented a compelling domestic image.

1 Adrian Forty, *Objects of Desire* (London: Thames and Hudson, 1986).

Figure 2
This radiopiano from the 1920s is an example of how radios were hidden in other products in order for the consumer to find it more fitting in the home. Other examples are radios that were put into armchairs and grandfather clocks.

Today, information technology is integrated in the home, and the concept of the "invisible computer"[2] is widespread. LG Electronics, one of the largest producers of electronics and powered appliances in the world, has moved into the promising area of "smart homes" with a product called "Internet fridge."[3] Internet fridge is a refrigerator with a computer hidden inside the door and the screen on the front panel. The computer is supposed to serve as a center for family information and logistics. Needless to say, the radio piano never was a success, for the Internet fridge, it remains to be seen.

How plausible actually is the idea of making computers invisible? And what role should aesthetics and design play in the development of smart homes?

Will all our hidden and integrated information technology just become another radio piano? The radio piano represents more of a humorous example than a warning to product manufacturers. If new smart home appliances are just a little more innovative than that, they might succeed. Of course, one could argue that we should know better almost a century and many design theories later. But what does it mean to hide powerful technology in order to make us accept it? And how will this domestic environment penetrated by reactive computers affect us?

Visions of the Future

Leading researchers present various strategies for technical and conceptual development of computer technology for the home. Mark Weiser from Xerox Parc first coined the phrase "ubiquitous computing."[4] Weiser foresaw how computer technology gradually will diminish in size, spread out, and become an invisible part of out everyday life. He envisioned a world of "calm technology"[5] in which our windows would become large screens displaying information in the background, or perhaps even the soothing sound of raindrops whose frequency indicates the number of emails waiting to be read

2 Donald Norman, *The Invisible Computer: Why Good Products Can Fail, The Personal Computer Is So Complex, and Information Appliances Are The Solution,* (Cambridge, MA: MIT Press, 1998).

3 Screenfridge (www.electrolux.com/screenfridge).

4 Mark Weiser, "Some Computer Issues in Ubiquitous Computing," *Communications of the ACM* 36:7.

5 Mark Weiser, "The Computer for the 21st Century," *Scientific American,* 265:3 (1991): 94–104.

in our computer. The walls of a smart home can become transparent or opaque as needed, and can quickly adapt themselves to mood or function. Nicholas Negroponte, the founder of MIT's Media Lab, advocates the use of "intelligent agents," a kind of digital butler that does all our work while we relax.[6]

Philips Design's project, "Visions of the Future,"[7] was one of the first to present domesticated information technology in well-designed and nicely packaged scenarios. Their core idea is to make IT appliances for social and emotional communication. According to Philips's head of design, Stefano Marzano, the home of the future will resemble homes of the past more than the homes of today. Technological gadgets will be gone, and a beautiful painting on the wall also will serve as a television and computer screen. The decorative object on the table will be a communication station, and the powder compact a mini-computer.[8]

Donald Norman explores the "Ubicomp" concept in his book *The Invisible Computer,*[9] and develops scenarios for an intelligent, reactive, and serving environment. The term was slightly changed in the EU research program "The Disappearing Computer," [10] which includes universities and organizations from all over Europe participating in sixteen imaginative research projects.

In the "smart home" industry, IT companies have adapted to reality and are aiming primarily at the large and wealthy '40s generation (the so-called Baby Boomers) that soon will become old and invalid.[11, 12, 13] Products being offered focus on "safety services," that is to say alarms of different kinds. These networks of sensors are concealed in the walls and appliances in the home, and are not subjected to any form of conscious design.

The idea that the computer will become invisible and disappear partly has its origin in Heidegger's observation about tools.[14] When we use a tool and become familiar with it, we no longer "see" it. The tool becomes "invisible"; a natural extension of our hands and mind. But Heidegger does not mean that the tool literally vanishes because, in that case, we could not use it. He refers to the phenomenon of things that are so well known that we no longer notice them. That is something different to actually *hiding* computer technology in walls or other products.

Product Design and New Technologies

Within product development and advertising, design is commonly used to disregard chronology and semantics. New, unsettling objects can be made to seem old and familiar or, vice versa, something old can acquire a new, "modern" look. The success story of the twentieth century is intimately connected to objects, and industrial design is like the soft padding around these objects. This explains our willingness to allow all of these objects into our homes and our arms, and also the reason why we abandon them for better and newer ones. At the beginning of the twentieth century, Peter Behrens started work-

6 Nicholas Negroponte, *Being Digital* (London: Coronet, 1996).

7 *Vision of the Future* (Bassum: V+K Publishing, 1996).

8 Stefano Marzano, "La Casa Prossima Futura" (Available at www.smart-homes.nl/abstracts/casa.html).

9 Donald Norman, *The Invisible Computer.*

10 The Disappearing Computer (Research initiative within EU IST [Information Society Technology] FET [Future Emerging technologies] program. See www.cordis.lu/ist/fetdc-ob.html.

11 Ehem (www.ehem.com/ehem/),

12 Hej Huset (www.vattenfall.se/hejhuset).

13 Sensel (www.sensel.se/).

14 Heidegger, *Being and Time* (Translation of *Sein und Zeit*) (New York: State University of New York Press, 1997).

Figure 3
Archiac radio

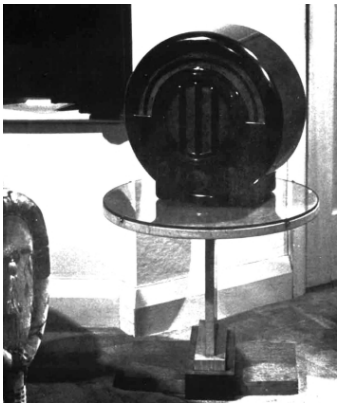

Figure 4
Utopian radio
Adrian Forty remarks that products usually go through three stages of design: the archaic, the supressed and the utopian. Here we see examples of the described basic grammar in the design of radios.

ing for AEG (Allgemeine Elektrische Gesellschaft), a company that primarily produced electricity and had begun to enter the consumer market. The problem for many electricity companies at the beginning of the last century was that usage was divided unevenly during the course of the day, and that it is difficult to store electricity. There was a peak during the morning, but then during the day consumption fell to almost zero, and rose to its maximum during the evening hours. In order to meet this changing demand, the companies had to have the same output capacity at every hour of the day and night. Obviously, this was not profitable, so many shrewd people were wondering how to increase demand for electricity during the day. One of the most successful solutions turned out to be kitchen appliances. The electric stove, mixer, toaster, washing machine, kettle, heater, and iron, to name just a few popular products, were developed in quick succession. Behrens designed electric kettles in three different materials and in ten different styles in order to satisfy every taste. Soon, electrical stoves and kitchen appliances started to appear in kitchens everywhere.[15]

A similar development occurred in all new technologies. The radio, for example, was developed around the beginning of the twentieth century, but was perceived as being too difficult and dangerous to use in the home. Radio manufacturers resorted to different strategies to overcome this. One was to change public opinion using advertising and "radio events." Another was to use design to make the radio more acceptable. Radios could be built into traditional wooden cabinets, or concealed in a grandfather clock or even in an armchair. But it was not before the radio found its rounded, utopian form in Bakelite that it became a product icon.[16]

In 1932, we could read in *Svenska Slöjdföreningens* magazine that:

> The radio as a cultural phenomenon is still very much in its formative stages. The chaotic lack of style in radio broadcasts has slowed down innovation within the industry. As far as the appearance of these devices is concerned, it can be noted that they have still not become an item of furniture that fits naturally into a room. The average radio with its built-in speakers still uses forms reminiscent of an oversized, clumsy table clock.[17]

The development of radios went through three design phases: the archaic, the suppressed, and the utopian. This has appeared so often in industrial design that they might be said to form a basic design grammar.[18] We can see the same development today within the field of smart homes. Broadband and IT technologies are entering our homes through a wide range of applications. From the first stages of crude technology and archaic solutions, they now have entered a stage of suppression. The products should not be seen at all.

15 Adrian Forty, *Objects of Desire.*

16 Ibid.

17 Red Lasse Brunnström, *Svensk Industridesign — en 1900-talshistoria* (Stockholm: Norstedts, 1997).

18 Adrian Forty, *Objects of Desire.*

Design and Semiotics

Is it logical that we will build technology only to hide it? The radio armchair was never a hit, and the clock radio did not have its breakthrough until fifty years later; and then it was the clock that was built into the radio, not the other way around. Every period and every technology needs to develop its aesthetics in an organic relationship with its own time. Hiding technology also means that we put aside and naturalize something very complex and problematic. Product design and aesthetics is what literally *expresses* the product. The product can be read as a text that conveys a number of semantic messages. On the denotative level, it tells us what it is and how to use it. When we analyze it, we can detect the connotative levels where issues about culture, identity, and context are buried. In his book *Mythologies,* Roland Barthes[19] explains the way myths work and the power they have on the way we think. Using many examples, Barthes shows how seemingly familiar things signify all kinds of ideas about the world. As Forty remarks: "Unlike the more or less ephemeral media, design has the capacity to cast myths into enduring, solid and tangible form so that they seem to be reality itself." [20]

One such myth is that household work nowadays is fun, easy, and efficient compared to the old days when housewives were chained to the kitchen. Household appliances are considered to have freed women to do paid work, and have made housework fun and fast. Housework seemingly does itself, with the contemporary homemaker only supervising the work. Household appliances were advertised as the "solution to the servant problem." But in fact, a range of studies[21] shows that women spend *more* time doing housework today that in the twenties. This is explained by higher standards in cleaning, cooking, clothing, and personal hygiene. Eighty years ago, shirts and underwear were at most changed after one week of use; today we rarely wear the same garment more than a day. So instead of sending laundry away to a cleaning lady once a month, the washing machine is on every day.

Hiding or Not Hiding—That Is the Question

Making or not making technology visible is a long-debated issue in industrial design and architecture. One of the main criticisms by the modernists at the beginning of the twentieth century was the inconsistent use of material, styles, and ornamentation during the previous century. The American architect Sullivan coined the expression "Form Follows Function," claiming that function was superior to form. Honesty in form, function, and material was another widespread motto. This meant that no material or function should be hidden behind something else, but clearly and honestly presented in the final design. But this was mainly a *theory* of aesthetics. In reality, most modernistic buildings hide all of their support structures under smooth surfaces.

19 Roland Barthes, *Mythologies* (Paris: Seuil, 1970).

20 Adrian Forty, *Objects of Desire.*

21 Ellen Lupton, *Mechanical Brides—Women and Machines from Home to Office* (New York: Princeton Architectural Press, 1993).

There are many reasons for hiding something. One is that it is ugly or untidy. At the Centre for User-Oriented IT Design (CID), at the Royal Technical University in Stockholm,[22] a study was made on five families that were asked to take pictures of ugly and attractive things in their homes. Most of the ugly things were technical appliances such as stereos, television sets, personal computers, bundles of cables, and light switches. We also might hide something because it reminds us of something unpleasant, or because we do not want to deal with it right now. In a therapy situation, the psychologist tries to unravel the client's memories and feeling that he or she has repressed into the subconscious. The main idea is that such subconscious material still affects the client even though he or she is unaware of it. Problems generally appear less frightening if we just look at them. Another reason for hiding something is that we do not want *others* to find out about it. It might cause problems or challenge our own position. Power often is concealed, and therefore is less obvious and harder to criticize.

A Modernist Revival?

The idea to remove physical signifiers is not new. Since Plato, the material world has had a subordinate position in the Western mind. For Plato, "form" was the creative force that manifested itself into the soulless flesh. The concept or idea always was superior to the real world object.

The aesthetic confusion and artistic debates prevalent during the early twentieth century led to a revival of these ideas. At a "Deutsche Werkbund" congress in 1911, the German design prophet Hermann Muthesius claimed that form was superior to matter:

> Much higher than function, material and technology is the FORM. If the FORM didn't exist we should still be living in a barbarian world.

The kind of forms Muthesius advocated were abstract, "essential" shapes and a standardized production system. In the audience were the young architects that would shape modernism: le Corbusier, Mies van der Rohe, and Walter Gropius. With them, decoration was banned from architecture and design, which would be made of simple geometric forms and clean, white surfaces. The idea was to make the signifier as invisible as possible so that the true idea—the FORM—would show through. This did, in fact, deny the material aspect of their work, and laid the ground for a building industry that became careless about material and sensual experience. In Sweden, modernism became more pragmatic and politically allied with the young social democracy, than the modernists in central Europe. In spite of that, they were just as aesthetically neoplatonically oriented as their German colleagues. In the 1931 book *Acceptera*, Swedish design theorist Gregor Paulson, architect Gunnar Asplund, and their

22 Beaudouin-Lafon, et al., "InterLiving Deliverable D1.1," "Cooperative Design with Families, 2001," "InterLiving Deliverable D2.1," and "Technology Probes for Families, 2002" (Centre for User-Oriented IT Design [CID], Royal Technical University, Stockholm).

friends advocated an ethically based aesthetic, with honesty in form, function, and material, as well as a self-evident form. This book has been enormously influential in Swedish design and architecture, and is clearly echoed in Monö (1997), when he disappointedly remarks about a line on a handle: "... from a semantic point of view this is false. It has been placed there purely for decoration."[23]

The idea to take away the references from products in order to make them more justified soon became a general modernist aesthetic. It culminated in the high modernism of the seventies, with its austere concrete buildings and black box design.

But taking away the signifier from things does not make them more spiritual. A raw concrete building with identical windows is not experienced as honest and true, but as impersonal and boring. What the modernist did not think of was how we human beings tend to interpret meaning into *everything*—including a white surface. From this perspective, the idea of making computers invisible by removing the visual signifiers appears to be a continuation of modernist ideas.

Criticizing Ubiquitous Computing

Augustin Araya[24] has analyzed the technological thinking that underlies "ubiquitous computing" using Heidegger's idea about technology as "conditions of possibility," and explored how technology reveals itself to man. According to Araya, Ubicomp changes the surrounding world to become not a separate entity, but an extension of ourselves. Constantly responsive, subjective, movable, and reproducible, it changes according to our needs and fantasies. This leads to two observations; one is that Ubicomp can be seen as a way to obliterate "otherness" in parts of the surrounding world by penetrating it with computer technology. The second is that Ubicomp obscures "otherness" in parts of the surrounding world in such a way that we are not aware of it—everything apparently is normal. Araya describes this phenomenon as "double invisibility":

- The penetration of computer technology in the environment becomes invisible.
- The effects they cause are invisible to us because we cannot see them.

This reminds us of the double invisibility[25, 26] in feministic theory

- The dominating culture becomes invisible because it is the natural, self-evident normality above interests of gender, class, and others.
- A culture in opposition becomes invisible because it gets less room in the public space and appears as vague, indistinct, and temporary.

23 Rune Monö, *Design for Product Understanding* (Trelleborg: Liber förlag).

24 Augustin A. Araya, "Questioning Ubiquitous Computing," *Proceedings of the 1995 ACM.*

25 Maria Uden, *Women Technically Speaking* (Thesis, University of Lulea, 1990).

26 Louise Waldén, *Genom symaskinens nalsoga* (Stockholm: Carlssons förlag, 1990).

By applying the theory of the double invisibility to Ubicomp, the suggestion to massively penetrate the world with invisible computer technology appears as a way to normalize, naturalize, and reify computer and information technology. The invisibility creates a power position where it is nearly impossible to criticize or change the prevailing system. Feministic theory also points at possible ways to act: to make relative the self-evident and to visualize the vague.

Product designer and writer Anthony Dunne[27] argues that mainstream industrial design uses its powerful visualization capabilities to propagandize desires and needs designed by others, thereby maintaining a culture of passive consumers. He suggests that design research in the aesthetic and cultural realm should draw attention to the ways products limit our experiences, and expose their hidden social and technical mechanisms to criticism and discussion. Central to Dunne's and partner Fiona Raby's work is a consideration of the imperceptible electromagnetism that surrounds us. From the "natural radio" emitted by the sun to the radiation leaking from appliances, Dunne and Raby attempt to visualize the invisible. In a series of conceptual design proposals, they criticize and visualize aspects of electronic culture that very rarely have been dealt with within product design.

Visualizing the Vague

Design is a powerful tool that allows values and cultural codes to be materialized into factual objects, thereby making them a "natural" part of the world. Design also can be used to criticize and deconstruct such values, but because design finds itself operating within a commercial framework, this rarely occurs. In the design of computer and IT artifacts, there usually is very little time for explorative and critical aesthetics. Product design is supposed to make an attractive and (at best) user-friendly product to increase sales.

In the light of the discussion in this paper, merely making computer technology invisible seems a dubious approach. Information technology is too problematic and powerful to be domesticated and hidden behind, or in, a familiar appliance. An environment penetrated by invisible computers most likely will affect the way we perceive ourselves as subjects in relation to an objective environment. It also appears as a way to normalize, reify, and naturalize computer and information technology, thereby making it a natural fact more than a cultural phenomenon. Every period and every technology needs to develop its aesthetics in an organic relation to its own time. Instead of hiding computer technology, we should use the power of design to visualize and express this complex issue. This is an important task for design research within the aesthetic and cultural realm.

27 Antony Dunne, *Herzian Tales* (London: Royal College of Art, 1999).