Sustainable 'disappearing computer' artifacts and spaces, designed for extended human use.

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Abstract:

In late October 2002 a DC atelier took place titles: "The use of 'Disappearing Computer' artifacts and spaces: designing for extended human use". This document serves as a recording of part of the output of this Disappearing Computer Atelier, that specifically addressed Sustainability.

Keywords: Artefacts, Human Use, Sustainability.

Introduction

The atelier *The use of 'Disappearing Computer' artifacts and spaces: designing for extended human use* proved to be very fruitful. It has provided a number of higher level concepts as results; these results can function as a roadmap of DC technologies at the extent that these technologies relate to people. The atelier was organized by Lorna Goulden, Irene Mavrommati and Alan Munro. Participants were: Fiona Rees (Philips), Fiona Raby (Dunne and Raby), John Cass (Philips), Achilles Kameas (Computer Technology Institute, Patras) Andy Wilson (Strathclyde Unversity), Paula Welen (Strathclyde Unversity), Panos Markopoulos (Technical University of Eindhoven), and

Nena Karagianni (Computer Technology Institute, Patras). All of the participants have contributed actively to the concepts, thought and ideas presented in this paper.

For Tales, we will focus particularly on the Sustainability segment of the workshop.

Addressing sustainability

The atelier was structured into daily activities. Activities of the 3rd day addressed the sustainability challenges that DC technologies are called to face. How do DC technologies fit in the global picture whereby 60% of the world's nations have a lower quality of life than they did 20 years ago. Of the world's population 78% are poor whilst 22% are middle income or rich. How do these technologies fit into a world where most scientists agree is at threat from global warming.

The issue if sustainability was addressed from three angles:

- Sustaining People: In what ways might Disappearing Computer technologies play a role in addressing individual and societal needs?

- Sustaining the Planet - How do Disappearing Computer technologies affect, positively or negatively, manufacturing and environmental capitals?

- Sustaining Profitability - How can Disappearing Computer technologies play a role in inspiring, promoting or supporting new forms of value exchange?

People: the sustainable self

Disappearing Computer Technologies could assist and improve people and their lives, in achieving a *sustainable self*.[1]:

A sustainable self is composed of a **physical body** that is healthy, exercises, eats a proper diet, gets ample rest,

and is **protected and secure** with ample shelter and surrounded by family and friends

and is allowed to express **affection** and share feelings, desires, emotions

so that you gain **understanding** of yourself, others and the world around you

which lets you **participate/serve** and contribute to your family, friends, causes, charities, and to allow yourself to be contributed to

which can be balanced by **leisure** to take time out, to "not do", to do things for the sake of pure enjoyment, to relax

which allows for **creativity** to allow your own essence, your distinct personality to come through in any form it wishes to be it music, art, dance, writing, sports

which gives you a sense of **identity** that special something in you that makes you distinctly you

which leads to **transcendence** and one's connection to all things, to know that you are one small piece of the whole

which liberates you to **freedom** and control of your own destiny. Your choices, your intentions, and your actions create your reality.

Sustaining profitability

We asked earlier, *how can Disappearing Computer technologies play a role in inspiring, promoting or supporting* ***new forms of value exchange?*** To attempt to answer this first we have to understand the relationship between *sustainability* and *profitability.* Sustainability is addressing people, planet and profit. Under this light, profitability does not only involve sustaining the commercial profitability but also sustaining the 'social and cultural profitability'.

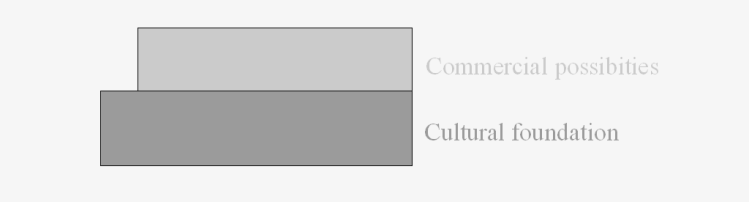

Figure 1: Commercial possibilities lay on top of a cultural foundations that supports and enables them.

As Rifkin has said, *From the beginning of human civilization to now, culture has always preceeded markets. People create communities, construct elaborate codes of social conduct, reproduce shared meaning and values, and build social trust in the form of social capital. Only when social trust and social exchange are well developed do communities engage in commerce and trade. The point is the commercial sphere is always derivative of and dependant on the cultural sphere. That's because the culture is the wellspring from which agreed upon behavioral norms are generated. It is those behavioral norms, in turn, that create a trusting environment in which commerce and trade can take place.* Commercial possibilities lay on top of a cultural foundations; it is the cultural foundation that supports and enables them (Figure 1). Supporting socio-cultural development is essential to ensure sustaining commercial profitability.

How could we sustain commercial profitability?

We take inspiration from the quote: 'Commerce must leave space for a form of culture that is independent from brand'. [2]. Commerce must not seek, as so many companies do now, to dominate culture. Rather it must step back, leave space for cultures to arise naturally, without coercion or manipulation. Commerce must provide other 'branded' offerings that *support rather than manipulate* social and cultural development. Both these things could happen through supporting new forms of value exchange.

We then must ask ourselves: *How can we understand value exchange? What does value exchange involve?* Analysing the idea of value exchange leads us to a number of conclusions. Value exchange involves:-

a) Transactions between corporations and individuals, individual to individual, corporation to corporation, …

b) Forms of values. Values that go beyond 'Money': currency, knowledge, time, space, information (gossip or secrets are included here), experience, loyalty, services, products, joy, choice, willingness to share, feelings, cultural heritage.

Thinking about this more explicitly in terms of the Disappearing Computer, we might ask, how could DC supported value exchange fit in this picture? What sort of value

exchange could DC technologies inhabit? A possible answer to these questions is Disappearing Computer technologies that:-

- Provide tools to *facilitate interpersonal sharing* (e.g., sees the city space as data base, treats people as portals),
- Provide tools to *support cross cultural communication* (e.g. context hopping),
- Provide tools to *encourage/prompt action*,
- Provide tools that *'learn'* so as to do the things above better over time, and to modify themselves to the particularities of the situations in which they find themselves.

It may be possible that technologies which are able to do this might enable new sharing and trading of resources between people, by reconciling what people either have lost or have a great deal of, such as involvement, space, time. A possible exemplar of this kind of trading could be *community loans*: someone having time (a resource) can exchange it for another service or resource that he/she does not have. For example, I have time but little money or space, you have money or space but little time and we find a way to trade it to our mutual benefit.

This thinking might seem outside the remit of looking at DC technologies in particular, but the more we consider the particular issues behind sustainaility and DC technologies, the more it becomes central. *Sharing is needed to make Disappearing Computer technologies sustainable.* Roadmaps towards a DC future should include the issues of the 'Sustainable' from the beginning that address 'Sharable' resources and expertise. This resource sharing and exchange can come in many forms, giving richness to the systems, and new content, but can also affect the very basic working of the technology, which we will discuss later.

Examples of DC supported value exchange might be *tools to support cross-cultural interaction*. (i.e. the DC value exchange supports the social trend for multicultural societies). Cross-cultural interaction includes the exchange of feelings, rituals, and information, towards understanding of the other culture. An example application could

be *Context Hopping*: Systems that allow people to somehow sample different cultural contexts[1].

Perhaps by creating focused solutions by DC technologies, topics and rituals of declining value could be supported. Different sorts of community membership and ritual might arise, as has happened with the Internet. Tendencies towards less involvement in communal/tradition rituals, loss of personal space / quiet time, the devaluation of public space the devaluation of public time, could be addressed by focused DC applications.

Here are some examples of possible DC solutions/ interventions to new forms of value exchange

- Supporting cultural activities in city-spaces,
- Use of people as portals/databases for DC technologies,
- Use city spaces as data-spaces and create value simply by living (i.e. in order to make cities safer, enjoyable, more culturally rich, etc),
- Pre-warning systems: these are driven by people's knowledge, but it is the DC system which enables the communication. (there is a traffic jam up ahead, the shop I'm going to is closed, the club I'm going to is full, etc),
- Systems to facilitate interpersonal sharing: maybe between new communities, maybe to promote political action and create cultural cohesion,
- People carrying an 'information disease' pick up information from visiting spaces and 'infecting' new spaces and situations with a different 'meme', such as a way of looking or thinking, or a new context (viral exchange),
- Community loans (like time share without commercial involvement): I have money but no time, I have time but no money, these two anonymous sharers lend money and time to each other), with DC technologies creating the arena and allowing the exchange to take place.

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[1] RCA end degree projects 2002: a bus-virtual presence example explained by F. Raby

Environmental Capitals effect of DC technology

The workshop went on to discuss *how DC technologies effect, positively or negatively, manufacturing and environmental capitals?* Discussion on this topic crystallised into four polemics: a) DC and Energy. b) DC Physical manifestation. c) DC and Human behaviour d) DC and other capitals

DC and Energy- energy implications of DC objects

DC devices are most probably going to be always on. Therefore the energy consumption of DC objects is likely to be huge, if we take in mind the cumulative effect of these devices. This would have huge implications if taken on a global scale. Because the devices are always on, the energy consumption of DC objects will be fairly constant. DC objects are likely to amount to tens or hundreds in the home. As well as this, various types of object might be worn, carried etc. Also, objects will be embedded in different ways in our physical environment. If we consider this number, and the amount of objects per person and per household as well as this infrastructure, we begin to consider billions of objects, should DC become an adopted technology. The energy implications of this are major. Even if the objects themselves are quite low in consumption individually, the *cumulative impact* on energy consumption is likely to be huge. We need to weigh this kind of energy impact of these devices against their usefulness. Therefore we have to start thinking of ways in which to mitigate this energy consumption. The situation where these object consume so much energy and exclude so much heat is not tenable in a world of global warming.

We come therefore to the 1st law of DC- *Each DC Device must strive to be energy independent*. As such it has to have abilities for multiple power source capture (solar, audio, kinetic). Perhaps there might be human-powered DC devices, or even DC-animal symbiotic hybrids. We might go from thinking in terms of batteries to fuel cells. The implication is that *it will be the object's responsibility and task to keep gathering and scavenging available energy as it can.*

DC Physical Manifestation

Like any other object in the everyday world, as well as a manifestation in terms of digitality, most DC technologies will be embedded into an actual object of some type. These different objects and infrastructures will have different properties, such as Size and Longevity. These objects, as said above, will be numerous. A person usually has one mobile phone. With DC objects, there may well be tens of objects to a person. These objects may well have different sizes and age differently. If we do not address sustainability issues, we risk making a significant environmental impact in terms of the amount and type of waste that they produce. *There is a need for the manufacturer to share the responsibility for the obsolete material*. Not only will companies manufacturing DC objects will have to set up supply chains, where objects are manufactured and distributed and sold to people. They will also have to set up *reverse supply chains* where objects which are now obsolete can be sent back to the manufacturer or agent, disassembled, and their various components or materials recycled. Objects must have the potential to be upgraded, dynamically reprogrammed in various ways, perhaps, as new possibilities come to the fore.

DC and People

Perhaps DC technologies can help us affect our relationship with our planet in positive ways. It might help us modify behavior that has major ramifications on a global scale, but is small or insignificant individually. For example: Overfilling a kettle is something which is small by itself but has major implications for the global environment in terms of energy wasted and heat produced. Small embedded devices could remind us of the optimal amount of water, perhaps judging from past behaviour. DC objects and technologies might be able to help us *see the ramifications of our behavior*- and even help us evolve our behavior in interesting ways through the visualization of these ramifications.

DC and other Capital

While not being Political Economists, we have been looking at the types of *capital* which might be embodied in DC objects. After all, capital is related to resources and value. The workshop came to the conclusion that that we need to find new ways of

accounting- so that we account for other things than Capital in the old, capitalist/Marxist sense of the word.

There are other models of the way we work together to create value than the standard ones of either capitalism or Marxism. There are other possibilities to look at, the non-traditional enterprises such as communes and communitarian ventures. The Cooperative, Mondragon [3], operating in the North of Spain, has been shown to be widely successful. This helps us see new possibilities of value and capital beyond the old. Two forms of capital were discussed in terms of DC objects, which lead to interesting and creative thinking of the types of 'economy' of the DC systems.

Digital capital: Value of particular pieces of data. Also the possibility of *data becoming a pollutant*, too much 'noise' 'gumming up the works', rendering necessary functions problematic. A current example of this is the Spam which clutters inboxes. Can we get rid of 'digital waste' by recycling it in some way?

Bandwidth capital: DC devices may be chattering to each other constantly**.** Who owns the bandwidth? Might we think of public access in the form of a digital commons, or private infrastructures, which we have to pay for in some way? There are possibilities from existing practice, of public access through many privately owned devices and infrastructures in a tit-for-tat altruism. We might view SETI as something like this, where individuals donate spare capacity on their machines to help process data for the search for extra-terrestrial life. This present example is only unidirectional in terms of resources, but it offers a vision of a world where these resources are multidirectional. Similar possibilities arise of the altruistic donation of bandwidth, and concomitant bandwidth borrowing. We note that some foundations and even local government are actively setting up public bandwidth for anyone to use (e.g. Wireless Leiden[2]), as well as other private concerns building 'hot spots' where people are charged (e.g. Hubhop.nl[3]). Perhaps we might use other techniques where local subnets of devices created locally as a local shared resource, perhaps using Peer to Peer technologies.

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[2] Wireless Leiden is a community-based 'open foundation' providing wireless access for the Leiden area in the Netherlands.

[3] E.g. Hubhop provides WiFi 'hotspots' in the Netherlands where people are charged for access.

Afterword

As we hope we have shown, this one part of the atelier raised a host of interesting and important issues with which we will have to deal with in the design, conceptualisation and use of Disappearing Computer technologies. We open this debate to the DC community at Tales and do hope that some of these very important concerns might be addressed in subsequent research in the DC community.

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