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ABSTRACT

In this paper we ask if contemporary and design theory for ubiquitous computing and internet of things is not outdated and irrelevant in view of some contemporary theories of agency.

General Terms

Design, Human Factors, Theory.

Keywords

Human-centered design, user-centered design, phenomenology, pervasive computing, ubiquitous computing, design theory, design research.

1. INTRODUCTION

The revolution in HCI sought to extend "human centered factors" into the design of desktop systems (Winograd & Florres [1]). However it was built around a stable notion of the user which is no longer the case. The present social and ecological situation, from the smallest scale of the city block to the greater megapolis and further, forces us to criticize the centrality of the user for design as anthropocentric and develop a perspective that is more sensitive to issues of emergence, complexity, and sustainability.

We propose to reintroduce the idea of Lifeworld to this debate, as it is the dynamic background that allows for mutual translation of languages of subjects that are part of the environment/city rather than self sufficient and independent users/subjects. The concept of Lifeworld that interweaves through philosophy from Husserl and Heidegger [2], [3], [4] might also help us to recognize the dialectical relationship of space and the social conceiving of space as something which is actively produced, rather than as a relatively inert container to enhance comfort and optimization as the user-centered approach to the technology continues to hold sway.

In the context of contemporary design issues such as large user groups and ecological sustainability we argue that ubiquitous computing should no longer conceive of agency in traditionally anthropocentric terms. In other words, we should try to organize the agency around dialectical relation between heterogeneity of users and environments and perhaps concentrate on the flow between.

In order to unpack the problem we suggest returning to the philosophical basis of HCI in its engagement with Heideggerian phenomenology. If Dasein is a spatial-relational emergent phenomenon, defined by the temporality as movement through a world as a space of possibilities, should we not thus adopt a view in which Heidegger's Dasein and Ding enter into Latourian "Parliament of Things" [5], [6], where the things have some agency and participate in the interactions? In other words, we can see the opportunity for rather fresh paradigm where the anthropocentric approach is subsumed into the "complexity of ubiquity" rather than the "complexity of ubiquity" into the anthropocentrism.

Within the field of media art / design research we recognize a number of practitioners who are creating diegetic prototypes from imagined futures. Natalie Jeremijenko's OneTrees Project [7] for instance planted and monitored 1,000 clones of the same tree in various places the project sought to create forum for public involvement in a debate between genetic determinism and environmental influence; a debate which has consequences for understanding our own agency in the world. Similarly, "Pigeon Blog" [8] project showed another possibility with pollution data gathering social experiment between animals and humans. We can thus understand projects such as the ones we mentioned as bids on the post-user-centered future of ubiquitous computing.

2. HCI AND HUMAN CENTERED DESIGN

Tradition of HCI has always turned to phenomenology to understand the relations between human cognition and the surrounding world of objects, things and nature. The main purpose of these explorations of phenomenology has been the need to create interfaces that would feel natural for people to use and enable them to easily interact with machines.

Winograd and Florres [1] are the ones, who are most famous for widely opening the phenomenological theory to the field of HCI. In their book *Understanding Computing and Cognition*, they have demonstrated how to use metaphors common to our everyday understanding of the world while thinking and designing computer systems and applications. One can object that middle 1980s was a different time and technologies, especially interfaces looked a lot different. But the central idea brought from phenomenology has prevailed since in the center of the HCI theory until today, expanded and perfected by many great thinkers

(Dourish [9] and others) as well as in the practice (Garrett [10], Goodwin [11])

We can observe, how roots of anthropocentrism in HCI come from the phenomenological interpretation. Heidegger's phenomenology takes the subject as the departure point for creation of the meaning and interpretation of the Dasein phenomenon. There is very strong emphasis on dualism of subject / object, which for general debate in HCI played role especially for explanation how do the subject relate to the surrounding objects, or more specifically, how do we interact with these objects and how do we use tools. Winograd and Florres's interpretation brought a lot of light into how the differences between the digital (or virtual) and physical (or real) work.

The context of the time is important; computer applications were different, built for different ends, with different ideas in minds of their creators. It was long before the spread of the internet and subsequently mobile technologies and before the quick development of mobile devices that integrate together the design archetypes of objects like telephone, photo and video camera, music player, radio receiver, jotter and other things that were never thought of before. The Web 2.0 wave established social media as everyday tool (that reshapes both communities and traditional media) and fully demonstrated their political power (Obama's presidential campaign over multiple social networking sites, Twitter as an important information and political tool during this year's earlier uprising after supposedly tampered election in Iran, Twitter-covered earthquake in China etc.). Especially the example of Iran shows the significance and importance of the mobility and also the penetration of the technologies everywhere around the world, even in places that are not traditionally part of Western cultural sphere.

Human centered design is not only a philosophy, but also a methodology still alive in practice at multiple levels and various industries, that is not to be neglected. Rather than that, it should be subsumed, merged into different approach to design of large information and technological systems. Computers and devices evolved from standalone objects through networked machines into multi-purposed mobile tools that interface people and the environment and that create large computational grids. Convergence of various technologies certainly plays a strong role in this development, as we move in the direction of including physical objects into the grid of computation and direct interaction with the mediated through technology.

Suddenly passive objects occupying silently the space we share with them start to relate to us through the mediated symbolic interactions, something we think of as being exclusive to humans. They start to occupy the information space as well and they act as members of meaning exchange. As Bleecker [12] points out, they are not just 'publishing' some information gathered through sensors, but that they do act as "producers of conversations that are relevant to others" and they are, as Bleecker calls them, 'first-class' citizens. We can see that recent development of pervasive computing and other technologies create a channels through which objects (and other non-human) gain certain social and political power, theoretically described by Latour in concept of a 'Parliament of Things'.

3. LEIFEWORLD AND LARGE INFORMATION SYSTEMS

The philosophical concept of lifeworld as conceived during the 20th century phenomenology, especially in the work of Husserl and Heidegger takes also a subject as a center of meaning creation. Things, objects and nature are pointing towards this meaning, they are active in creating it. However, the implicit dualism of subject/object is being complicated and blurred as mentioned above. The subjectivity is being subsumed into objects and creates hybrid entities that break out of these dualistic categories. These agents can be humans, things, objects, animal but even larger entities like natural systems .

I argue, that lifeworld itself implicitly emphasizing the inseparable connection between us and the world, is a good departure point for understanding the pervasive computing in broader terms of translation of meanings between all subjects that are involved in the exchange. Moreover, it helps us understand the dialectical exchange of meanings between these agents as they influence the space and the social conceiving of space, that is now being populated not only by human individuals acting upon inert background, but as a space formed by various alliances between collectives composed not exclusively of humans, but of various kinds of agents with different kinds of languages, meanings and agencies. That is to say, address the relation between the spatiality of networks and temporality of lifeworld.

4. ANIMATE ENVIRONMENTS

The importance of things in the creation of the meanings related to our lives that are implicitly temporal has been discussed through different fields. Another traditional field that looks at relations between subjects and objects and the role these relations play. Most notably in anthropology, with Levi-Strauss [13] or Kopytoff [14] discussing the biographies of things. In this case the biographies are not being told by the things actively, but are made available by research and explorations of researchers. Sherry Turkle writes about evocative objects, the objects "we often feel at one with" [15]. This metaphor make us think about some objects that at might be necessary for our existence (pacemakers), but most of them are bound to us much more loosely. Even though these bonds might be more emotional than we often think and we might feel very differently when we don't have these objects near us, like mobile phones. Things in general have power to evoke memories, they concentrate meanings around them, that can be personal, shared within families or even larger social groups, as nations. They trigger thinking.

Pervasive computing introduces the paradigm in which these objects actively participate in meaning creation and meaning exchange. Even though some people still like to dispute, that it is the computer that gives us the information gathered through sensors. There is still a strong distinction between digital and physical (or, in older terms, virtual and real).

This distinction, however, is slowly disappearing. The digital is slowly moving towards, it is more and more linked to the real world. The pervasive computing is only first step and we can already see a successful effort in completing this step. That is not only to subsume computers into things, to equip things with some sensors that will broadcast data, but to make things that are computers. The MIT Center for Bits and Atoms led by Neil Gershenfeld presented some materials that are able to do some

basic computational functions with very little energy consumption. The objection addressing the possibility of 'removing' the computational part fades with fading distinction between the thing and the computer, between the physical and the digital, as they become inseparable.

The anthropology suggests that the environments enhanced by large information systems occupied by various agents of hybrid nature participating in the meaning exchange become something that resembles the animistic cultures. This direction brings us to think that the emphasis of design processes in these environments should not be targeted only to humans, like in human-centered approach, but rather concentrate on thinking about the flow, that is happening between both human and non-human elements, as well as between the environments and their elements and finally between environments themselves.

5. THE FLOW BETWEEN ACTANTS IN ANIMATE ENVIRONMENTS

It seems somewhat important to include more complex notion of relations between spatiality and temporality into the design processes that would address contemporary social issues and issues sustainability. That is the reason I want propose to concentrate on the flow. The idea of a flow emphasizes the dialectical exchange and implicit temporality of these relations.

In traditional phenomenology, Heidegger fails in establishing the spatiality in temporality (Dreyfus, [2]), but he shows in his fundamental ontology how closely the two are related.

Regions of space filled with things are either near or far to us and are not defined in metric units of plain distance, but by our care. The idea of care is anchored more in the concept of temporality rather than spatiality. This care is something that works one way - this is a good point at which to ask how this concept of care changes with contemporary technologies - suddenly it is not necessarily one way relationship, but rather a flow of meanings that are exchanged in multiple ways.

It might be interesting to concentrate on the idea of flow that is emerging between the agents of large information systems that work as translation networks. It is a flow that represents the elements of the environment in their different organization and the temporal and spatial relations between them. The idea of flow implemented in the design process possibly enables us to some degree to see how to model things, spaces and experiences as a side effect of everyday life. This somewhat unorthodox approach towards pervasive computing is giving us the possibilities to create not only new types of objects that will communicate, but rather to create new types of ecologies with complex agencies to promote sustainability. Where human-centered design approach puts the dualistic image of individual with its needs and ends, there is a complex nexus tied into the lifeworld, being constantly connected in the flow of meanings and information within the system of translation networks. If we take this complexity as a departure point for the design, rather than designing tools and interfaces for the user itself, we will arguably be able to produce large information systems for new ecologies suitable for complex challenges of the present. It is arguably a response to the challenge that current state of world presents to the traditional dualistic view of subject/object that lies at the core of user-centered design approach.

6. CONTEMPORARY ART PRACTICE

The phenomena described over the course of this paper can be observed among few projects that have been realized during last decade as a pioneering efforts in the field of pervasive computing. They somehow show us the complex hybrid environments and they can demonstrate the utility of the approach that takes into account the complexity of ubiquity.

The Pigeon Blog [8], using animals, demonstrates how we can turn something that has been seen for a long time as unwelcome in our city spaces to create some meaning. The pigeons, embedded with 'wearable' sensory equipment, fly around the city (which is a thing they do anyway) and gather data. Suddenly, the pigeons turn from the problem, into the solution of some other problem. By 'enhancing' them with the computers, we can translate into our own language things that the pigeons, as well as us, probably realize anyway, but suddenly there is a tool that makes the data quantifiable, they can be used in the debate. The pigeons start to participate in the network of mediation, disseminate meanings about the state of the local environment.

The OneTrees [7] project goes even further and demonstrates that the actual technology can play role only at some point of the process. The author of this project, Natalie Jeremijenko has prepared genetically identical trees that were placed around in the environment and let grown. By simple comparison one could make an assumption how clean the environment is over the course of the long time. Even though this project does not use any ubiquitous computing technology, nor sensors and any other computer parts, due to the genetic manipulation it gives us referential point without which we would not be able to infer the meaning. In her discussion with the architectural theorist Benjamin Bratton that was published as a part of the Situated Technologies initiative, Jeremijenko asks the question why the trees are not taken as the part of 'Parliament of Things', as they have no sensors. But I would argue, that the ultimate idea of the translation networks that allow things such as 'Parliament of Things' has necessarily nothing to do with the sensors itself, or the way, look or type of the technology. From this point of view, Jeremijenko's genetically modified trees participate on the creation of meaning and hence they are part of it because they do work within the translation network.

The Fish Communication [16], a project done on Hudson river, where the authors placed a grid of buoys with sensors underwater and small light above created an interface through which the people passing by could somehow experience the presence of the fish, and not only presence but also a movement through the space. This installation quickly instigated social action as the audience started to initiate interaction with the packs of fish through feeding them. This latent interface brings us the possibility to observe some parts of the environment that are otherwise inaccessible to our cognition.

These examples demonstrate how the use of technology can enable meaning sharing by interconnecting different entities within the environment between themselves. The Latoureaux translation networks of mediation are becoming visible through the use of embedded hardware, or through genetics. Things, objects can freely pass from the realm of world of occurrence into the realm of available. The flow between the elements of the environment (fish, tree, pigeon) is what becomes of more importance than the element itself.

7. CONCLUSION

The work in the field of HCI has taken as the central problem the relation between an individual and computer via a software interface. The foundations for this paradigm were laid by Winograd & Flores that got inspiration for thinking on how do we interact with the surrounding world from the phenomenology. However, as the technology evolved, we have witnessed integration of several technologies that enabled us to think of Ubiquitous Computing as contemporary cutting edge paradigm in computer systems. However, except the partial effort of few theorists (partial as they do not explicitly cover Ubiquitous Computing) the debate on underlying philosophical principles has somewhat stalled in the realm of Human Centered interaction paradigm, taking as the point of departure the human individual itself.

This article proposes to take as our central point of view not the user itself, but the complex ecology of the interactive systems, alliances of loosely bounded actants that are not only human and have different agencies.

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