Aspects of human interaction with collections of objects translated into artefact architecture specifications

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Abstract:

On Wed. 28 November – Tue 4 December 2001, in the Netherlands a DC atelier took place titled: 'translating aspects of human interaction with collections of artifacts into artifact architecture specifications". This document presents the output of this Disappearing Computer Atelier.

Keywords: Artefacts capabilities, Human Use, Component architecture Plugs, e-Gadgets.

Introduction

In the DC atelier workshop addressing how aspects of human interaction with collections of objects can be translated into artifact architecture specifications, the participants contributing were: Kieran Delanay (NMRC), Achilles Kameas, Irene Mavrommati (CTI), Anthony Pounds Cornish (Univ. of Essex), Lorna Goulden, Geke Deetman, Slava Kozlov, John Cass, Fiona Rees, Anton Andrews, August de los Reyes, Steven Kyffin (Philips Design). During the course of the atelier, the concepts of component architecture for tangible artifacts (taking the e-Gadgets[1] and MiME [2] project concepts as a starting point) were explored and expanded upon. The atelier has advanced further one of the key concepts of e-Gadgets: Plug capabilities and their connections. Plug concepts were detailed, and structured in clusters. These results are

briefly described in this document. Additionally the atelier has produced an establishment of common understanding among the organizations partners, especially relating to higher level concepts of artifacts and their collections.

Human interaction with collections of objects

Most objects in our everyday lives have been designed for specific tasks; but this specificity constrains the ways we might use them for. In general, everyday objects can be used in different ways, providing that the limits of their physical properties are not violated. As everyday objects are "enhanced" with sensing, computing and communication capability, in order to become artefacts, people have to learn any new ways that they can be used (that may have to be indicated by appropriate new affordances) and the tasks these objects might participate in. People may initially have to use objects in more complex ways. Moreover, people may end up interacting at the same time with individual objects and with their configuration.

The introduction of artefacts is expected to affect people's everyday lives at least in two ways: Firstly, people may have to update their task models, as they will no longer interact with a computer but with computationally enabled objects. On the other hand, these new artefacts will be capable of participating in many more new and complex tasks. Secondly, people may have to change established habits and form new models for the everyday objects that they use. The conceptual models people have of objects and of computing may have to evolve in order to incorporate the new affordances of combined computationally enhanced objects. One of the several issues to be investigated at this level, which we may call the "syntactic" level is how can artifacts be designed so as not to contradict our existing models? Is there a general architecture upon which artefacts could be based?

Some concepts to start with

Attempting to apply component architectures principles in the world of tangible artifacts, the project e-gadgets has produced the following key concepts, that were discussed in the course of this atelier and elaborated further:

The basic definitions [1] underlying this generic concept are:

eGadget: it is an autonomous and self contained artifact. It has both a tangible and a digital shelf (although these two may not necessarily reside together). It can be any everyday physical object that has communication abilities, and a range of sensing, acting, processing abilities. Processing in particular may entail "intelligent" behaviour, manifested at various levels

Plugs: Objects have several capabilities, coming out of their software or their tangible shelf. They have a physical shape, weight, colour, they may give services (lights for example), they may be squeezable, shakeable, grabable, liftable, containing. Extrovert gadgets express their capabilities through plugs. This is so that other gadgets as well as people using them, know what to do with them (connect them, plug them to each other).

Synapses: They are associations between two compatible Plugs. They are invisible links, explicitly created to achieve a particular working of the two capabilities together.

Gadgetworld: The result of linking objects together via invisible links, is a Gadgetworld. It is formed purposefully by a designer, a user, or even an intelligent agent. A Gadgetworld consists of artifacts which communicate and collaborate in order to realize a collective function.

The generic framework that supports these add hoc connections, is called **Gadgetware Architectural Style (GAS)**. It is GAS that defines the concepts and mechanisms that allow people to create Gadgetworlds.

The food-for-thought outcomes:

Plugs are expressing the capabilities of eGadgets that are connectable and thus may form synapses. By forming valid synapses (links) a Gadgetworld (collection of artifacts that serves a certain function) is created. Manipulating plugs is what people can do, in order to use objects in more complex ways; by manipulating plugs and synapses created by plugs, people interact not only with the individual artifacts, but also with their configuration.

For classifying plugs, we initially speculate on patterns of usage of artifacts by people, and address the issue of how people perceive artifacts. Thus we indirectly address the issue which set of peoples' actions should artifacts perceive.

Plugs could be classified into higher and lower level plugs. Lower level plugs represent a single capability (i.e. a certain kind of sensor), while a higher-level plug is manifested to the user as a single plug that represents a higher-level function (a plug that is an organized collections of simple, atomic plugs).

Plugs can be hierarchical, and move from lower level plugs (Quantitative) to higher level ones (Qualitative, more abstract higher level goals related to human conditions). The table below (table 1) shows a possible hierarchical classification:

Quantitative capability to activity to qualitative condition

Physical condition (Facts)	**Things / actions**		**Human condition achieved**
heat	monitor	synthesis	Happiness
sound	memory	Manage, organize, translate	Comfort
light	Recharge / generate	Direction, inteligence	Cleanness
water	To be reset	Building a history, pattern	Friendship
energy	to be organized	Make combination of offers	Energize
Information (media 1, 2, 3)	transfer	Facilitate relationship	Somber
	combine	Read the need	calm
e.t.c.	e.t.c.	e.t.c.	e.t.c.

To passivity

Table 1: possible hierarchical classification of plugs

The Plug manifesto[1]:

1. Plugs have **internal structure**. All gadgets have basic plugs. They also have a program that can combine them into higher level plugs. We need a way to describe composition of plugs.

2. **Object capabilities can be one of the dimensions** that the object exists in. Then an object exists in a multidimensional space. Then we can use a topology to study

[1] The Plug Manifesto was proclaimed during the atelier by Achilles Kameas, John Caas, Slava Koslov

the behavior of the object, which might tend to behave according to patterns and probably could prefer certain neighborhoods of the space.

3. **Higher-level plugs are synthesized dynamically from basic plugs** using a function. The system has memory of the function it has used.

4. An eGadget knows of its **physical properties** and of their state. It acquires this information from its designers and from other eGadgets, which may be asked. (i.e. a lamp thinks it is lit, but a book tells it it is not actually lit, so the lamp may think that the bulb is burned).

5. **Transient interactions** are also taking place among objects. Transient interactions are also taking place among objects, apart from synapses build on purpose. Example of transient interactions can be self-announcements, queries on location, abilities, etc.

Broad classes of information are:

- Who I am
- Where I am
- What can I do
- In what state I am
- (How others perceive me)

6. There is a **common plug** used to advertise the eGadget capabilities. The common plug is like a commonly accessible **open discussion channel**. All eGadgets register themselves to use the channel automatically. It is used to query and find out which eGadgets-abilities are available.

7. There can be two ways of perceiving plugs:

a) **Hidden from the User**: Every gadget has one plug, which has an internal structure. There is an (intelligent) mechanism which ensures that an eGadget is associated with another in the best possible way.

b) **Analytic**: If the user is skilled with using plugs, then he might be given access to the internal plug structure so that he can manipulate each plug separately.

The first approach permits the capabilities of an eGadget to be changed transparently and dynamically. The second allows the user to exercise more control of the system. We need a mechanism to translate from the first approach to the other.

8. With every plug there is a **degree of confidence associated**.

9. Things in the digital world could happen **much faster** than things in the physical world.

10. Interaction through a **synapse** is always **initiated by one of the parts**. Interaction happens on a "Q&A"[2] basis and on a 'DO' basis (performances). Acknowledgement may also be requested. For each plug attribute there is at least a 'set' and a 'get' method.

How plugs relate to each other

Plugs can be ranging from lower level to more complex, higher level. Several ways they can link to each other are described in the following sketches (they are digital versions of the original sketches developed during the atelier), which constitute one of the atelier's more important outcomes. (image 1)

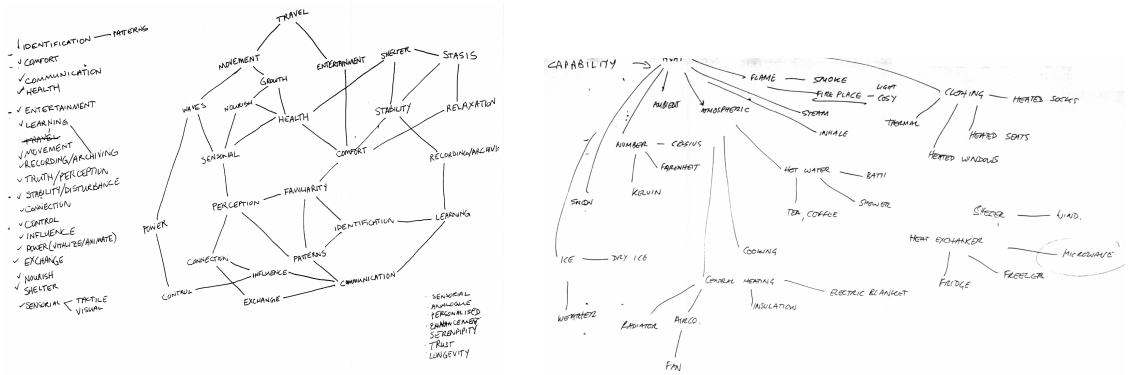

image 1: Sketches by Lorna Goulden showing how plugs relate to each other

[2] Q&A: Question and Answer

Conclusions

The workshop was highly multidisciplinary, nevertheless holding a User Experience Design focus. The atelier was structured and organized from the beginning having a cascading nature (starting with a large number of people, representing many disciplines and giving input, and ending with a smaller number of people to reach conclusions. All participants of this workshop felt it brought fruitful results in terms of:

- Common ground that was established: especially regarding understanding and potential of the concepts of artifacts architecture.
- The levels on which people related aspects would influence such architecture were discussed extensively, leading to inspiring ideas.
- The e-Gadgets project concepts (especially regarding the expression, structure and capabilities of the Key concept of Plugs) were notably enriched. The process of atelier discussions gave useful input to the project, that was used in the eGadgets project concepts and technology deliverables.

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References

1. e-Gadgets project website: www.extrovert-gadgets.net
2. MiME project website: www.mimeproject.org