Near field interactions with the internet of things

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Papers

Social Construction Kits for Kids

Digital Infrastructures for Pervasive Play

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Position paper for the NordiCHI 2006 Workshop:

Near field interactions

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What I bring to the table

Myself

I am a Ph.D. fellow at the Center for Interactive Spaces (www.interactivespaces.net) as part of the *Nomadic Play in Mixed Environments* project. The project is a collaboration between LEGO Company, University of Aarhus and Aarhus School of Architecture.

In my master's thesis, *Digital Habitats* (Brynskov, 2004), I elaborated the notion of 'habitats' as a general, somewhat vague Gibsonian-inspired ecological perspective on Human-Technology Interaction (May & Kristensen, 2002) and defined a set of concepts that tied together three important perspectives on human activities involving elements of pervasive computing: physical, informational and conceptual. This general framework has been applied to several work and non-work domains, including pervasive gaming which will be published as a chapter in the book *Semiotics and Intelligent Systems Development* (Andersen & Brynskov, in press).

A research agenda

With the still earlier adoption of mobile phones, instant messaging and various digital entertainment systems, pre-teen and early teenage children – tweens[1] – are becoming heavy users of mobile computing technology and digital services (Brandtzæg et al., 2005), at least in 'Westernized' societies. In 2000, the age at which half of all Norwegian children in their year group had a mobile phone was around 13, in 2004 it was between 9 and 10 (Ling, 2005). A recent Japanese report (Japan Mobile Market, 2006) projects that the percentage of 5- to 9-year-olds owning a mobile phone will go up from 29% in 2004 to 64% in 2007. This pattern is in line with our local findings (Brynskov et al., 2005). In other words, it is not so much a question of whether or not children should be using these new media, but rather how they will be using them and what for.

The title of this position paper, "Social construction kits for kids", has at least two readings: (a) It can emphasize the social situation around *physical* construction kit activities. This would include two children building a LEGO model together. They share the experience and develop ideas together with the physical model as a focus of joint attention, the physical manifestation of a shared goal. (b) It can also refer to *social* construction in the sense of Searle (1995) and Tomasello (1999), the active, ongoing, cognitive co-construction of mental models of the world by culturally embedded humans. This perspective includes children's use of mobile phones and instant messaging to maintain their social network of friends, peers and

[1] In the literature on popular child culture, the term "tween" is usually referring to girlhood and girls between 7 and 12 years of age but it may as well include boys (cf. e.g. Mitchell & Reid-Walsh, 2005).

phones and instant messaging to maintain their social network of friends, peers and family using, and to construct their identity as the move away from childhood into adolescence. This second perspective is a conscious step away from the "little engineer" approach of so many tech toys.

Experience with children and design

During the course of a variety of research and development projects, I have worked with different aspects of design of pervasive systems, most of them involving kids. Some focused on developing methods for participatory design with kids, some on theoretical aspects of pervasive computing and gaming, but all of them involved building prototypes. E.g., I built *StarCatcher*, an ultra-simple tech version of the classic team game capture-the-flag, using a smart phone-Bluetooth-GPS-webserver combo. Lately we have been exploring the latest incarnation of Flash Lite (from Adobe) in combination with Python (on Nokia Symbian Series 60 phones) and other creatures such as gumstix (www.gumstix.com).

Currently I am focusing on the development of *DARE!*, a prototype example of a game genre that we call *mock games* (which I presented at DIS 2006 [Brynskov & Ludvigsen, 2006]).

...and great expectations

I look very much forward to, hopefully, meeting a diverse gang of people at the workshop. I like Julian and Nicholas' writings, although we've never been in touch. Let's have some fun.

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Bootstrapping the Internet of Things

OK, so here's how our bootstrapping story goes. It has a lot to do with getting a useful interaction out of the devices we can deploy to as opposed to dreaming up an interaction and hoping for a device to enable it.

Using Bluetooth scanning cell phones we can detect very data rich enviroments even today. Some of this data comes from full blown spimy objects like cell phones or computers and some of it come from less informative data sources. In most cases the devices aren't really considered public by their owners, the broadcast into public space is more of a communication accident that we can profit from.
Couple of problems though:
1. Scanning is a relatively slow process and
2. it does not provide any focality - there's not a physically simple way for you to indicate an interest in a particular object - what you're getting is an overview of all items close to you (range 30 ft typical).
In typical tests that's a lot of data (anywhere from 5 to 50 objects depending on venue)
3. the things around you don't really consider themselves parts of the Internet of Things yet. They are not truly objects with a history but simply names.

The first two limitations makes direct physical interaction with the data objects around you clunky at best, lacking immediacy and directness. It becomes an experience much like observing the world through a periscope - and for that reason discovery on its own, bootstrapped like this is a less useful process than you'd like.You end up working your spime-sensing prosthetic more than you're really interacting with the environment.

The way we're addressing the problem is by providing memory to the situation. In fact we consider recognition (as opposed to discovery) the first important interaction we can add to a place to answer one of your questions. Memory provides at number of things:
1. Focus - well known objects are more important to you than unknown objects
2. Spimification of the passive objects you encounter: While they are not keeping track of their own history, you are actively providing them with a history by remembering your encounters with them.
3. Context - the objects around you are enriched with the context that you're seeing them in. This adds a lot of data to the things around you: Who do they most likely belong to, what is your history with them. We can augment the data you are observing in place with background data pulled from

the net and we can augment the interactions the objects afford with actions we can provide on our own.

- you could argue that we're really making up the internet of things on our own based on a bunch of data id's we're seeing and you'd be right but if that's the only way to get the internet of things off the ground then...

It's all part of a story for bootstrapped spime that unfolds in three stages
1. Discovery - the fact of the scan
Being done by us and applications like mobiluck, sixsense
2. Recognition
This is one of the core things we're doing for our mark 1 application - examples that don't feed back well into the space you're in is stuff like bluetagging. Arguably when you bluetag a photo any bluetooth device caught in the scan is mblogging the photo as well
3. Interaction - the context you're providing to objects will enable interactions
A very nice example of a good located interaction is the Salling Clicker - http://www.salling.com/ - which provides a deep interaction with a located object, but that unfortunately has no discovery mechanism built in and (as far as I know) no memory either. It is open ended, you can configure it on your own - but software on your PC can't announce itself for control through the clicker so you don't really get the kind of casual interaction that you want from a physical world of things.

The point of our applicaton is integrating these three phases allowing you to casually learn more and more about your world and adding the interactions as you familiarize yourself with the world

Responsible design of connected objects.

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This position paper will attempt to illustrate how the new paradigm of the "internet of things" will support a shift in thinking in users and professionals towards more responsible and sustainable practices and behaviors, using "Stint", a service designed around a collectivity of connected objects.

If we dig a little further into the current trend of the "experience economy" and PSS (UNEP) i.e. a product service society, we are encouraged to address sustainability by encouraging people to seek value from what they have access to and not what they own. On the opposite end of the spectrum however, mass customization and rapid prototyping are also on the rise as business practices follow the user-generated trend. Easy access to material goods, however personalized they might be, might lead to what one might call "moral hazard" (Reid J. Lifset, 2005) as our thirst for new and exciting products and material-based experiences have increased tenfold (J.Chapman, 2005). The semantics of objects is lost and disposal is easier because ownership is no longer valuable. This is where connected objects might play an important part.

"The internet of things" seeks to illustrate the value of connectivity and ubiquitous computing by tagging and keeping track of our surrounding everyday objects. This will become relevant in the objects we will design in the future. This means that a layer of retrievable, virtual and linkable meaning can be associated to any given object and as designers we might start to consider objects as part of an eco-system, a collective, a society of objects. This might in turn address how we design such objects and the interactions we have with them. What are a user's expectations of a connected object and it's capabilities? Would the use of an object change when it is semantic understood as belonging to a family? In the case of "Stint", that question was addressed and offered one of many solutions.

Stint is a music sharing service made of physical tokens that link to people's music. The way that a person collects and interacts with those tokens is communicated to a widget that also talks to the main music application online. Each physical object links to someone's musical donations. A typical user would therefore collect all these tokens as representations and physical links to the music that each person would send them, in real time. To have access to that music as it reaches each token the user has to push each one. This physical connection with the object itself allows the system to record and track what content is accessed, but also allows the object to take an active part in the system. As time goes by each stint will get used and show who are the people whose collection that person has interacted most with. Inversely she will be able to identify if her friends are listening to her music by looking at their objects or their virtual and connected counterparts.

In this case study, the connected objects were treated in such a way as to physically show and display the use which matched the data being collected. The design approach goes far beyond what is traditionally considered product design (ergonomics, aesthetics, industrial processes) but starts to scratch the surface of new ways in which practitioners could use technology to infuse life and meaning into objects that make people want to build relationships with them that are more meaningful and rich than what is currently available. A new set of behaviors and semantics will change people's understanding of the material world and eventually change their consumption habits as each object's history becomes as precious as the object itself.

In conclusion we can expect to see a change in the practice of product design as connected objects become more popular. The interconnectedness of physical elements is bound to play a part in how we will design the behaviors and interactions they will have with each other , with their users and between users.

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NordiCHI'06

Workshop on Near Field Interactions

Position Paper

PERvasive serviCe Interaction

The ability to associate electronic tags to any object essentially transforms any object in a source of information enabling the Internet of Things. Yet, the success of the Internet of Things hinges on a number of issues including the ability to deliver services on any terminal independently of its features and finally the ability to provide a usable interface to objects and services.
Besides, physical mobile interaction based on RFID or NFC communication technologies is gaining importance. Physical mobile interaction actually exploits the familiar way we interact with real world objects to provide intuitive access to digital information and services associated to physical objects. Moreover, the mobile phone is now the most adopted personal computing platform for accessing and using digital services through the interaction with physical objects. For instance, NTT DoCoMo is now providing an i-mode FeliCa service made possible by the synergy of NTT DoCoMo's mobile Internet service, i-mode, and Sony's contactless IC chip technology based on NFC, FeliCa. Hence, i-mode FeliCa service allows users to pay for a movie by simply waving their phone at a theater machine.

We would like to introduce during this workshop the PERCI (PERvasive serviCe Interaction) collaboration project between DoCoMo Euro-Labs and LMU-Munich University. This project aims at combining physical mobile interaction and the Internet of Things in a generic way. Its goal is to support the development and deployment of mobile interactions with the real world and to explore how user interfaces can be optimized to provide easier and more intuitive interaction with physical objects and their associated services.

While providing a vision and a system framework, The PERCI project has also led to the development of several prototypes evaluated through user studies (see Fig. 1 & 2). For our approach to mobile physical interaction we came up with two use case scenarios for mobile ticketing; as examples for an interface distributed between a mobile phone and a physical object. We actually developed an application based on posters augmented with NFC tags (See Fig. 3). Similar to pushing buttons on an automat, users can touch different options on the posters with an NFC-enabled mobile phone such as the Nokia 3320 with the Nokia NFC shell. The mobile phone selects options through the recognition of the corresponding NFC-tags are attached to the back of the posters. After the user has assembled all necessary options, a client application on the mobile phone calls a Semantic Web service associated with the poster. The mobile phone interface rendered from an interface description guides the interaction with markers on the physical object and manages the invocation of the associated Web service.

One important challenge in our research is to enable users to access the Internet of Things. In our scenarios, the user selects with his mobile phone (electronic or visual) tags attached to the physical object, with the aim to access specific services. While it is very easy to swipe a phone in front of a tag, it is however rather difficult to guide the user interaction. Another central issue is the user control over the system: as the physical mobile interaction with services is a process with possibly several steps of execution a focus lies on the user's role in the interaction loop. This involvement calls for support for special cases such as reversible actions and fault actions.
Our project also aims to shift the interaction focus from the mobile phone to physical objects and explore how we can derive generic user interfaces from the object and the service description. We want to push service functionalities and options off mobile phones, map them to multiple markers on physical objects and thus turn these into rich ubiquitous interfaces for new and more complex interaction techniques. Instead of struggling through glutted menus, users should be able to choose options and invoke services simply by selecting appropriate wireless markers on physical objects. Contactless technologies implement only one of the many possible interaction techniques, namely *touching*. So far our framework supports *touching* (NFC / RFID) as well as *pointing* (visual markers, infrared beam) and *scanning* (Bluetooth). Furthermore it supports interaction techniques such as *location based object selection* and *user mediated object selection*.

Within our PERCI Project, we presents a system enabling the mediation between physical objects and multiple services through a *Universal Client*. Our work focuses on the composition of independent services which should be provided to the user in a consistent and seamless way. In our implementation, we use Semantic Web services for the description of services associated to physical objects. By using Semantic Web service technologies we see a great chance to overcome the

semantic incompatibility between different services. Moreover we can benefit from describing services semantically to automatically generate an abstract user interface utilizing the proposed semantic user interface annotations.
Indeed, the semantic service description is used in our project to derive an abstract and generic user interface, which then enables the automatic generation of a concrete user interface on the mobile device (See Fig.4). The service description defines the type of user dialogs during the interaction (e.g. multiple selection), but neither specifies which graphical widgets are to be used (e.g. checkboxes) nor their look and feel. The type and appearance of widgets is decided at run time according to the phone capabilities and the user preferences.

To conclude, The PERCI project investigates the potential of physical mobile interaction with real world objects in the context of Semantic Web Services. It provides an understanding of how generic user interactions can be abstracted, modeled, and implemented. However, further key issues would still have to be tackled such as how to avoid private information to be involuntarily provided during the interaction process? How to reduce the user interaction with the mobile device even further?...

Fig. 1. Paper prototype

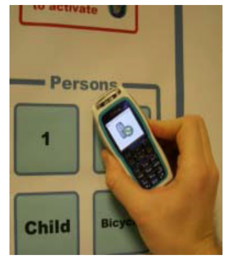

Fig. 2. NFC-enabled mobile phone

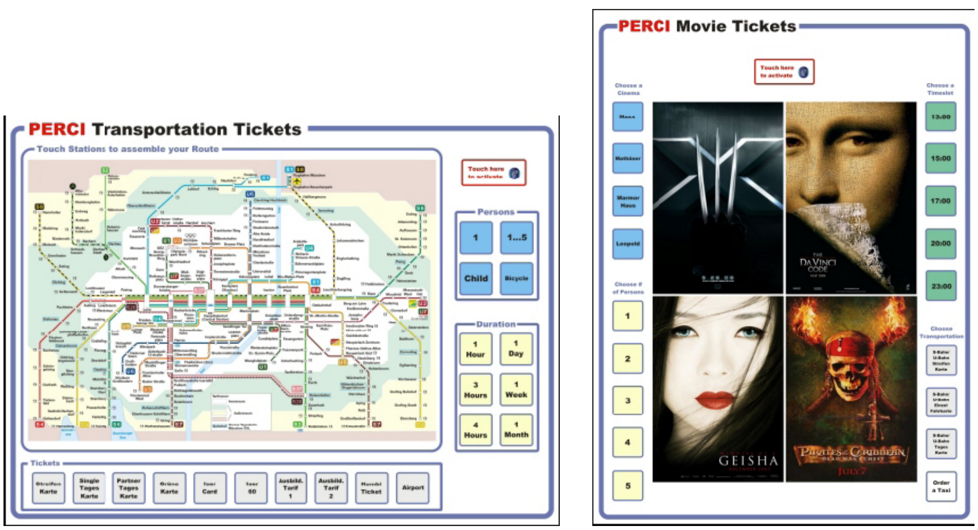

Fig. 3. Transportation and movie posters with NFC-tags

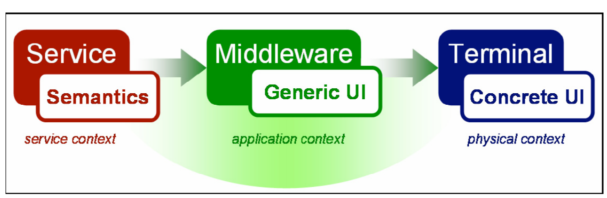

Fig. 4. The User Interface compilation process

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You Can Only Touch What Is There:

Intangibility & The Internet of Things

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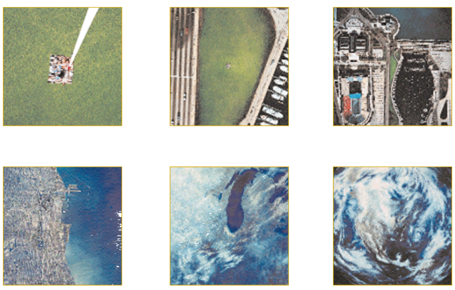
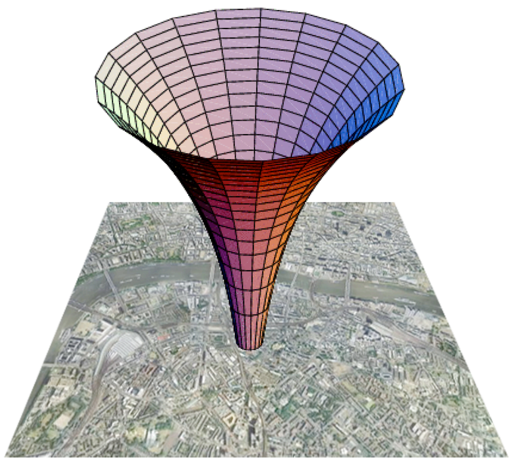
Touch is a quick, easy action that lets you select from the objects around you. It is tangible & categorical: there is almost no margin of error.

However, dealing with intangible objects – notably those far away – leads to naming conventions & difficulty distinguishing between many objects.

One of the main filters will be relative location – ie. how far something is from you. This works best at the power or order of magnitude level, for example the Powers of Ten video[1] – accuracy is less important the further away something is.



This can already be represented programmatically via the GeoOnion RDF vocabulary[2]. If there are still too many selections, further refinement could be given by sector or angle, e.g. selecting friends in the USA, or items that are south of you.



One possible interaction is a single key press to zoom out: this was used by Gate5 (labelled Helicopter View) to get a city map overview before returning to the previously selected view. Otherwise, a wheel could provide quick selection of range, with tilt to select a sector or vague direction of the object to select.

[1] Powers of 10, Eames Office, http://www.powersof10.com
[2] GeoOnion: http://esw.w3.org/topic/GeoOnion
[3] Smart2go / Gate5: http://www.smart2go.com

Chris Heathcote is an interaction designer with 7 years' experience, working for companies such as Nokia. He helped define the basic interactions for the NFC protocol.

Security Aspects in Design of Touch-based Applications

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RFID has been subjected to lots of scrutiny and doubt from the civil liberties organizations, as governments, corporations and other institutions have been adamant in their quest to embed RFID tags into everyday objects. The primary fear is that they could be used to track the movement of people in an unauthorized fashion, and also be used as a tool for identity theft [1],[2].

However, in all these scenarios it is the individual citizen, who holds the RFID tag in his shoe or passport, and it is the evil, faceless institution which carries the reader, and with it, the power to control its subjects.

Near Field Communication turns this scenario upside down. Now the NFC readers are in the hands of the people, and they can choose what to do with the RFID tags. Problem solved? Not quite. In fact, there are some other concerns that are created once readers are built in every single cell phone.

The security and privacy concerns for the RFID-in-your-purse scenario can be roughly categorized in the following groups:

1. Data leakage. If an unauthorized person can access data on your RFID chip, they might be able to determine who you are, your Social Security Number, your nationality, credit card number, etc. These might then be misused in a variety of amusing and less amusing ways.
2. Tracking. If an RFID device can be coached to respond an unique identifier in any way to a certain command, it can be used to track the object in question. This identifier might take the form of an anti-collision ID (anti-collision is the phase before any real communication is made; before encryption comes to play), an encrypted blob of data, or some plain text data.
3. Forgery. If an RFID tag (e.g. a ticket) can be replicated and reused, it might mean significant loss to the issuer of the tag. Or if the tag can be physically replaced with something else (e.g. a TV set tag is replaced with a shampoo bottle tag), it lends to all sorts of misuses.

When the reader is in the mobile phone or some other complex. portable device, we have some other security concerns:

1. Denial-of-Service. RFID communication takes a lot of power, and in a battery-operated device an entity making constant communication might be able to draw the battery flat.
2. Loss of device control. An RFID tag is dumb, and does not contain other functionality, and therefore the damage caused by its destruction or takeover would be contained. However, a cell phone would present an interesting target to a cracker, since gaining access to it might give financial advantage to the attacker, e.g. in the form of free calls.
3. Destruction of the device. A powerful enough electric field (e.g. an “RFID killer” device) might overload the electronics, and render the phone useless in part or in whole. (Though in all honesty, this really has nothing to do with RFID as such: a phone can be destroyed by putting it in a microwave oven already. But the fear of RFID in general might cause the proliferation of “RFID killer” devices, turning this into a danger to non-RFID and RFID-phones in general.)

However, many of these concerns are for the device manufacturers and policy makers to really to worry about. What does a designer have to care about when he is building his own Near Field Communication application, then?

The NFC device has typically three communication modes:

1. Tag reader/writer.
2. Peer-to-peer communication, where two complex devices communicate and exchange data.

For example, a laptop and a phone; or a car and a GPS receiver.

3. Tag emulation, where the cell phone presents itself as a tag towards any outside reader, e.g. a credit card. The cool thing, of course, being that the user has the power to turn this off at will, which alleviates quite a few of the privacy concerns.

We always have to think about the possible consequences of a security problem. In the tag reader case, the data leakage does not pose usually much of a problem, because the tag could be read by the attacker anyway, since it's not protected. However, the tracking of the devices which read a particular tag would be a privacy issue. Granted, it would be approximately equal to keeping logs on a web server, but it would still make the holder of such a log subject to data privacy legislation.

In a peer-to-peer to case the transferred data can be far more sensitive than in the simple tag scenario. In the design of such an application the designer must observe the fact that NFC active communication can be read from far greater distances than in the tag case, and use appropriate protection on the transport.

There are also secondary effects which are not immediately obvious by looking at a design. One of the key characteristics of NFC is that it's *localized* to the extreme. If someone accesses your service, you can pinpoint their location down to almost one metre for the instant they touched your tag. This would make a simple web service location-aware without the user's knowledge.

Also, things such as the design and placement of the tag can create context information about the user that he might not think he is divulging: e.g. placing multiple tags in different heights could reveal user's height.

At any rate, technical design can solve only a subset of security and privacy issues relating to touch-based interaction. The key is in the user's mind: if he thinks the system is insecure, he will not use it. And therefore it is important that any deployed application fulfils the following criteria (in addition to usual software/hardware security matters):

1. It is transparent to the user. No service should do more or something else than what it appears to do, or at least do so in an invisible manner.
2. Intuitiveness. If touching two devices together do not provide a consistent user experience, it will create uncertainty in the users. In some installations this may be desireable (e.g. games), but in most other cases the experience should be somewhat what was expected.
3. Protection against forgery. At it's simplest, it means that wherever you are placing the tag, it should not be easily removed and replaced with a similar-looking, yet hostile tag. This represents a challenge to the physical design of tags out there in the public.
4. No hidden costs. Even at the moment, access to the internet on cell phones might be expensive, and therefore it's quite important that the users are aware of what their phone would do and how much will it cost when they touch a tag.

Of course, this discussion concentrates on addressing some immediate user concerns on NFC technology. Once NFC and its usage has become more familiar, there is more room also in the commercial space to really go wild, and begin the proliferation of NFC services. The key principles will still remain the same, though.

The author works for Nokia Technology Platforms unit, and continues to be involved in the NFC Forum specification work. He lives in Helsinki with a bride and three mice.

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Use of Near Field Communication in emergency Rescue situations

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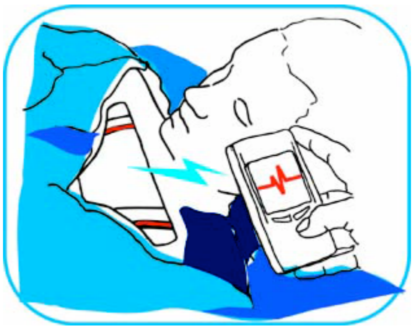
Near Field Communication (NFC) where the placement of two devices in close proximity of each other makes it possible for two devices to exhange and share information, opens up for a variety of transparent and intuitive interaction possibilities. However, as we have identified in the palcom project [1], instant and appropriate feedback regarding state of the connection and identification of which devices are connected to each other, is crucial for use.

In our concrete example we are working with a mobile biomonitoring system called the Bluebio monitor [2], intended for monitoring injured persons especially in prehospital work related to major incidents and everyday emergency response situations. The BlueBio monitor is a device intended for placement on the chest region of an injured person. The device has 3 electrodes for measuring the pulse of the patient by use of ECG, a small CPU , a battery unit and Bluetooth ranging up to 100 meters. Each BlueBio monitor connects via Bluetooth, to a Base station capable of handling up to 20 devices. From the basestation the monitored information can be transmitted to devices in the emergency area via Bluetooth and to the relevant hospitals via GPRS. The BlueBio monitor is being developed through a participatory design process [3] involving different disciplines ranging form sociology, computer science, medicine, emergency rescue, engineers and and industrial designers.

In the following are three examples of use of NFC in relation to the BlueBio monitor:



When the biomonitor is placed on a patient, ECG signals are transmitted through a basestation to the surrounding environment, and via GPRS to the hospital in charge of koordination. The communication is wireless implicating the need for knowing from which biomonitor the emergency staff is receiving signals. If the emergency medic is close to the patient, the medic can place her display device with an RFID tagreader implemented close to the biomonitor. The tagreader identifies the RFID tag on the biomonitor, and data from the specific biomonitor is displayed.

When Major Incidents happen, the rescue personnel such as firefighters, will try to remove the victims from the dangerous areas, and move them to an emergency assembly area. Here the state of the injuries are assessed, and decisions are made regarding which paitents are the most critical and need transportation to the hospital as fast as possible. Many patients will be gathered in a small area waiting for further transportation. The emergency staff will be monitoring the patients through direct contact, but also via the biomonitors placed on the patients. If the state of a patient changes dramatically, a visual alarm will be activated by the patient. This alarm device can also be used for "browsing" through the patients as shown in the illustration. When data is received from a specific patient in browsing mode, the visual indicator by the patient will light up.

When the patients are transported away from the accident site, the Ambulance personnel, will read the RFID tag on the biomonitor. This serves three functions. Firstly it activates the data display in the ambulance so the patient is monitored in the ambulance during transportation. Secondly, it tells the emergency staff on site in charge of coordination, that now the specific patient has left the area. Thirdly, the hospital is notified that a new patient is on the way.

NFC in relation to emergency situations needs to be palpable [1]for the users, meaning that systems are capable of being noticed and mentally apprehended. Connections between devices must visible at request and feedback from connected devices must be easy to notice and unambiguous.

As shown in the previous examples, NFC plays central role in managing coordination and monitoring of victims of a major incident. Wireless networked technology offers the possibility of "Zooming" between close interaction with devices and a more withdrawn overview by the use of small handheld devices. Local interactions can inform others in remote locations and vice versa.

Emergency situations are stressful and successful interaction with devices is crucial. Users in these situations need to interact with devices in a smooth, understandable and intuitive way. In other words, if NFC systems work under these conditions, there is a good chance they will work with our handheld devices in our everday life.

[1] PalCom project web-page. Available: www.ist-palcom.org

[2] M. Kyng, E. T. Nielsen, M. Kristensen, "Challenges in Designing Interactive Systems for Emergency Response," DIS conf. Designing Interactive Systems, Pennsylvania, 2006.

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DESIGNING SOCIAL AFFORDANCES FOR MATERIAL OBJECTS

An example of Thinglink service

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Abstract

This paper focuses on annotating physical objects with contextual information from the viewpoints of affordance theory (Gibson 1979) and practical design of "Internet middleware". Our starting point is the notion that linking user-generated meanings to everyday objects equips physical artifacts with new types of affordances, which we call here as *social affordances* (Kreijns &Kirschner 2001*)*. These social affordances differ from the notion of perceived physical affordances (Norman 1988) in three essential aspects. First, instead of functional, their nature is principally social/socializing (Adler 2001). Second, instead of being defined by designers, social affordances are primarily defined by users. Third, unlike physical affordances, social affordances are historically accumulative; the more people annotate the same object, the richer its affordances become.

The historical-accumulative nature of an annotated object is enabled by its positioning in a networked information ecosystem, from which judgements about the object may be gathered over time. Virtual-physical linkages such as bluetooth, RFIDs or printed labels connect these two worlds for the annotated object. In such an ecosystem, fragmented knowledge is linked by the essential actions of *identification* and *pointing*.

In the Architecture of the World Wide Web Vol 1[1], URIs are described as "identifying distinct resources", and it is claimed that "global naming leads to global network effects". By identifying resources with URIs, references in data from multiple sources and services can be merged to form a rich aggregation of knowledge about a resource.

The most valuable information about an object in an information network is not found in descriptions or traits of the object: it is in the relationships that the object holds with other resources. By *pointing at things*[2] and saying why, datasets may be linked and the bigger picture may emerge.

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[1] http://www.w3.org/TR/webarch/

[2] http://www.plasticbag.org/archives/2005/04/the_age_of_pointatthings.shtml

Following the success of Open Source, an Open Data movement is occurring online that seeks to gather, publish and enable the reuse of rich machine-readable datasets. This data would previously have been available only to large institutions having the financial means or the time to obtain it. By positioning an object's information in relation to a shared dataset such as Wikipedia, Open Streetmap or Thinglink, (e.g. http://thinglink.hackdiary.com/thingtagging/), the network effect is enabled and flat lists become rich graphs of information[3].

The necessary critical mass of annotation systems and annotated knowledge is not expected to emerge solely for the purposes of annotating physical objects. By bootstrapping on existing Internet infrastructure - URIs, HTTP, and higher-level facilities such as blogging, locative services and social bookmarking applications - object annotation can grow as the Web itself grows. For example, del.icio.us, the social bookmarking application, does not care what the URLs it annotates are pointed at. Specifying points in an information space whose axes are User/URL/Tag/Time, its applications emerge from use.

The purpose of our paper is to discuss possible information architectures for social affordances in the context of a free open database called Thinglink, where people can register unique identifiers for meaningful objects. Central questions are:

- What kind of social affordances (relations between people and objects) are suggested in the descriptions of thinglinked objects on Thinglink database?

- What is the role of the network in supporting/expanding the identified social affordances?

- What Internet services (eg thinglink.org) are a natural fit with, or can be easily mapped to, this activity?

- How do these design considerations affect the building of web APIs or other 'internet middleware'?

Keywords: social software, unique identifiers, Internet middleware, mediation, social affordances, user interface, API

[3] http://www.hackdiary.com/archives/000070.html

The Kinetic User Interface

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1 Introduction

The idea of networked location-aware objects is nowadays possible thank to various types of localization technology (Hightower and Borriello 2001), ranging from tabletop and indoor (e.g. RFID or ultrasonic badge) to outdoor scale (e.g. PlaceLab, GPS). Since fast improvements of localization technology are expected in the next years, it seems reasonable to think about new ways of exploiting this technology also beyond logistics or vehicle navigation systems.

Some emerging applications for outdoor localization are those related to social computing, such as geo-tagging (e.g. SocialLight[1]), or those related to collaborative pervasive games (e.g. CatchBob[2]). At tabletop scale, one of the most interesting research trends is Tangible User Interfaces (Holmquist, et al. 2004). In Tangible User Interfaces (TUIs), everyday objects are used for simulating, and to a certain extent also extending the ordinary Graphical User Interfaces (GUIs) by means of direct manipulation of physical objects. TUI is the first step towards Physical Embodied Interaction (Dourish 2001). Tangible interactions are intended to replace GUI interactions and elements with operation on physical objects, but there are nearly no new types of interactions induced by the nature of the physical space and objects. An alternative approach to interaction with physical space would be to exploit properties of objects' motion (such as path, speed, direction and acceleration) and let applications make sense of these dynamic features in a new way, mainly as intentional actions.

Our goal is to design a new class of user interfaces for mobile pervasive computing environments, populated of interconnected location-aware fixed and mobile devices, possibly embedded in everyday objects. This class of user interface includes TUIs as specific cases, and extends them towards larger geographical scales. We call this type of interface, Kinetic User Interface (KUI for short). In KUIs, the motion of location-aware objects in a physical space is interpreted as first-order input for pervasive applications. KUI interaction patterns can be defined just as in ordinary GUIs, and they be consistently used in different pervasive applications running on heterogeneous pervasive environments.

With KUI we endorse the Weiser's Ubiquitous Computing vision (Weiser, 1993) and the Dourish's Embodied Interaction vision (Dourish 2001). KUI is intended as new interface design paradigm for pervasive computing systems where *motion* of objects in physical space determines the execution of actions on the computing space, for instance item selections, service requests, database updates, etc. To put it in terms of Instrumented Interaction (Beaudouin-Lafon, 2000), the space becomes an *instrument* and the motion is one of its afforded *actions*.

In KUI, motion is a first-order (or primary) interaction modality afforded by the physical space to users through the motion of mobile devices. The system is able to recognize the current location of mobile devices and to make sense of motion parameters. Motion as input modality can be used alone or in combination with other modalities afforded directly by mobile and fixed devices that are located in the interaction space, such as ordinary point and click or speech recognition.

Although users might not always be aware of what effects will be caused by the motion of the mobile devices they are operating, they should indeed be aware that their motion is detected and interpreted by the system and that this will react in one way or another. Conversely, we expect KUI to provide a certain degree of freedom to mobile users allowing the occurrence of "incidental interaction" with the environment (Dix 2002) and thus a serendipitous effect in using the KUI in non-standard, possibly unknown situations.

2 KUI interaction patterns

While most KUI interaction patterns can be radically different from GUI patterns, some of most powerful GUI patterns, such as Drag&Drop and Focus, can be transferred and adapted to KUI interaction with physical space. For instance, in a KUI-enabled SmartHome environment, the user can "move" a media that is being played on a

[1] http://www.socialight.com
[2] http://craftsrv1.epfl.ch/research/catchbob/

computer-controlled appliance from one room to another (provided that there is a suitable player in the destination room). KUI makes available to the user the Drag&Drop pattern for moving the media by carrying, while moving, a meaningful location-aware object (e.g. the remote control with a RFID sticker on it). It is worth noting that the Drag&Drop pattern is provided as an interaction pattern by the KUI middleware and can be activated for specific applications such as the SmartHome control system[3].

Another useful pattern in KUI is (auto)Focus. As an example of an application of Focus, consider the outdoor situation where the user is driving a car and the car's motion parameters (obtained, for instance, by a GPS tracking system) reveal that the car is decelerating in the proximity of a gas station (i.e. a geo-located landmark known to the application). This pattern is detected by the KUI and it is interpreted by the application as a fuel refill need. This hypothesis might be corroborated by gathering and checking other information from the current car context (the fuel level sensor) and the system can be expected to pro-actively prompt the driver of the current prices at the gas station. The application might also perform higher-level inferences and inform the user that keeping the current speed and considering the current fuel level he or she can reach the next gas station that has better gas prices.

3 Conclusions

Many research projects have been focused on how to improve location awareness of mobile devices, while very few projects have investigated issues on how localization technology can be used in human-computer interaction. While we do consider of fundamental importance the first type of endeavour, we also believe that research and experimentation should also focus on the potential use of localization technology in new scenarios. That's why we consider of central importance the definition of new classes of scenarios that might be enabled by current technology or by their future developments. In the specific case of localization technology, we believe that localization technology as it is now is ready to be exploited for innovative applications. What is missing, most of all, is a unifying framework and agreed concepts that define a new design space. As pointed out by (Dix et al. 2000), the spatio-temporal dimension in pervasive computing is an asset that should be better exploited in the design of interactive mobile systems. With KUI we extend the possibilities of localization systems with an additional level of interactivity and integration with pervasive computing services (see also Pallotta et al. 2006).

By including KUI in the mobile pervasive computing design space we expect to ease the development of new interactive scenarios that will certainly augment the potential of the "Internet of Objects" vision. With KUI we intend to move towards an "Internet of Moving Things" as a further step in the development of the Ubiquitous Computing vision.

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[3] This interaction pattern is similar to the Teleport application (Addlesee et al. 2001), which allows users wearing ActiveBadges to move their desktop environments from a PC to another.

CybStickers
– Simple Shared Ubiquitous Annotations for All

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We describe a system where ubiquitous personal multimodal annotations are created, accessed, and shared using existing camera phones, current operator infrastructure, and stickers as new ubicomp artefacts. These stickers combine a *technical* component with a *usability* component in order to facilitate usable and intelligible interaction, as well as creating new business models.

Keywords: Ubiquitous computing, annotations, sticker, usability, personal annotations, electronic graffiti

CYBSTICKERS

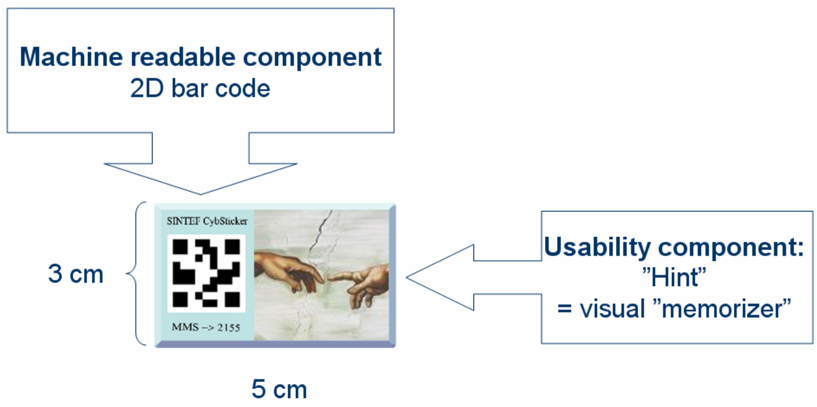
Some messages are situated in a spatial context or location. For leaving and reading messages like that and thus facilitating physically integrated interaction, we may use existing mobile phones and physical artifacts such as stickers. A message can be connected with a unique ID built into the sticker, which then works as a key for inspecting it through wireless lookup. The ID may be contained in the sticker in various ways, e.g. coded in text, as an encapsulated RFID, as a standard or 2D barcode, or otherwise.

Our **CybStickers** system addresses the following ubicomp challenges:

- The user cannot easily annotate the physical world
- Annotating requires specialized hardware and software as well as infrastructure
- Existing annotations are invisible without some sort of ubicomp “magic eye” system, leading to difficulties in intelligibility and usability, i.e. usability is not only a user-interface issue, but an issue encompassing the connecting artifact as well.

The *CybSticker* is an adhesive but removable vinyl sticker which contains two elements: 1) A **technical component**, the *matrix code* (two-dimensional bar code) containing a coded unique identification number, and 2) A **usability component**, a general artistic designed image called the *hint*, which, if properly selected by the user, conveys a hint of the contents, and thus serves as a teasing wrapping for the real contents, also creating new business opportunities for designing, branding, and selling cybsticker sheets and cybsticker brand services, which generally need not be limited to the MMS format. We hypothesize that using these hints will provide a much more understandable, entertaining and usable system for personal augmentation.

A cybsticker typically looks e.g. like this:



All cybstickers have unique matrix codes, whereas the hint is the same for large groups of stickers, and serves as higher categorization means for the contents.

We have chosen a matrix code, since such codes are easily readable by camera phones. The code chosen is of our own design providing 32 bit address space. Also in the first version we chose the existing MMS service as the basic carrier for cybsticker communication, so the user will not have to install any additional software in order to use the service. All matrix decoding and processing is done at the specialized MMS server.

The cybsticker system is then used for leaving personal multi-modal notes in the public space, or for enhancing objects with information, e.g. in treasure hunts, or personal commentaries to places and objects. These stickers incorporate elements from existing MMS usage (Ling, Julsrud, & Yttri, forthcoming), blogging (Nardi, Schiano, Gumbrecht, & Schwartz, 2004), graffiti (*Graffiti Primer*, 2005), personal note sticking, and emoticons.

An example should illustrate the use:

John and Marie is sitting on a park bench hugging and kissing. Now Marie wants to leave a memory of this here. She grabs her newly bought sheet of cybstickers and peels off one with a suitable image of a heart as hint and sticks it to the side of the bench. Using her camera-phone, she takes a picture of the matrix code and composes a standard MMS message, writing "John and I really enjoy this place: We call it 'Kissers Bench'! Marie". She adds a picture of her and John, the sound of another kiss to it, and sends the MMS to the special CybSticker reception number written on it, before leaving.

Later that day, George sits down on the bench. He notices the CybSticker and as it shows a heart, he gets curious, so he takes a photo of it and sends it as an MMS to the CybSticker short number. After a short while he smilingly receives the MMS message that Marie put into the sticker.

RELATED RESEARCH

There are other systems using different kinds of “umbilical connections” between the physical world and information space, such as infrared beams or GPS for position detection. *Cyberguide* (Abowd et al., 1997), the FET IST project *HIPS* (O’Grady, O’Rafferty, & O’Hare, 1999) are examples of these. For using stickers as mediating objects, the art project *YellowArrow* (Counts, 2004) comes closest to cybstickers in functionality. It also uses user-placed stickers and mobile phones for this kind of interaction where the user contributes to the content, but it contains no usability component, so all yellowarrow stickers are visually similar, and the system uses only SMS-functionality with manual input of ID-codes for facilitating the information flow. Additional picture input or map location is facilitated through a web interface for pc.

Matrix codes for providing interaction links using camera phones are described in (Rohs & Gfeller, 2004) and used in *ShotCodes* (*ShotCodes*, 2005) and *SemaCodes* (*SemaCode*, 2004), as well as the very popular Japanese Quick Response or *QR codes* (ISO/IEC, 2000), used for broadcasting info via tags that are read by mobile phone cameras.

We intend to create a generic model of these different kinds of augmentation links in order to support the design of such augmentation systems.

CHALLENGES

A challenge in ubiquitous computing (Bellotti & Edwards, 2001) is to create systems that are both *usable* and *intelligible*. The term ‘disappearing computer’ is problematic in that it presents a system that is difficult to know the presence of, not to mention to control. The CybSticker approach attempts to address these issues by making the virtual-real artefacts clearly visible to the user and understandable by using a user driven “pull” model for the information access.

In our upcoming CybSticker experiment, involving the two larger operators in Norway, as well as the biggest content provider in Scandinavia, we will test the usability and intelligibility of the system, as well as using a more experimental or exploratory computer science approach to explore and describe the emergent usage patterns of this location-based multimodal “peercasting”. The target group will be users aged 18-24 who may use the cybstickers within a confined test area over a period of several weeks for free the autumn of 2005.

The results of this testing will be described in an upcoming paper.

CONCLUSION

The intelligibility and usability challenges of ubiquitous augmentation are met by using new tangible objects (stickers) which are easy to apply and to detect as being part of the physical world, while still providing access to information through widespread and familiar terminals (camera phones) using familiar software (MMS).

The cybstickers seem to represent an engaging, new and fertile ground for simple and feasible ubicomp, involving aspects of tangible user interfaces (the sticker artefacts) as well as pervasiveness in a form that may be easily adapted and experimented with. This provides a good starting point for introducing facilities for usable and intelligible pervasive and augmented information system annotation services to the general public. We believe that the usability component, the hint, will be a defining factor for creating usable commercially viable augmentation services.

This work is performed as part of the author's PhD thesis under the auspices of the Norwegian Science Foundation grant FAMOUS (*Framework for Adaptive Mobile and Ubiquitous Services, 2003-2006)* at SINTEF ICT, May 2005.

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Mobile Life v2.0

Proposal for Workshop: Near Field Interactions // Nordichi 2006,
October 14 – 15 // Oslo, Norway

Mobile Prosumer

The idea of the Mobile Prosumer

Provide relevant product information to the consumer on his mobile phone. The Mobile Prosumer aggregates content from various online sources for display on a mobile phone, using Near Field Communication (NFC) to facilitate interaction between product and consumer.

A typical usage scenario for the Mobile Prosumer
Imagine: You are in a large electronic store on a Saturday with a lot of other people about to buy a new TV flatscreen for your home cinema. You have already checked some websites at work, where different products are compared, but there are some fancy new models you cannot remember from your web search and an older model you were not sure about, but which is now lowered in price. You definitely want to buy one that exact day.
What would you do?

- Wait to ask the stressed shopping assistant who wants to sell the most expensive product anyway?
- Or call your tech-savvy friend George to help you?

With the Mobile Prosumer you can simply fetch your mobile phone, scan the code from the product you are interested in and get all the relevant information delivered to your mobile phone display within seconds.

Our approach

- Research in real life scenarios by experiments and action research methodology
- Near Field Communication (NFC)
- Service oriented architecture (SOA)

The mobile Prosumer is a case study and prototype currently developed in Berlin, Germany. The prosumer prototype is to be tested in a RFID enabled part of the Kaufhof store in Aachen, Germany in 2007, in cooperation with Nokia and Philips. We seek more discussion about the actual setup, functionality and content sources and mainly the acceptance of such solutions with consumers in consumer scenarios. As NFC might be the break-through achievement of learned interaction with mobile devices and the advancements of wireless near field standards, consumer solutions become possible.

Setup

Currently we are developing a vertical prototype for use with Nokia 3220i phones (See Figure 1). We are also evaluating various content sources: product comparisons and product tests from commercial sites (like test.de), user generated product descriptions, ratings and usage experiences. Possible new functions such as personal content selection, collaborative filters, "add product to shopping cart and send home" need to be discussed.

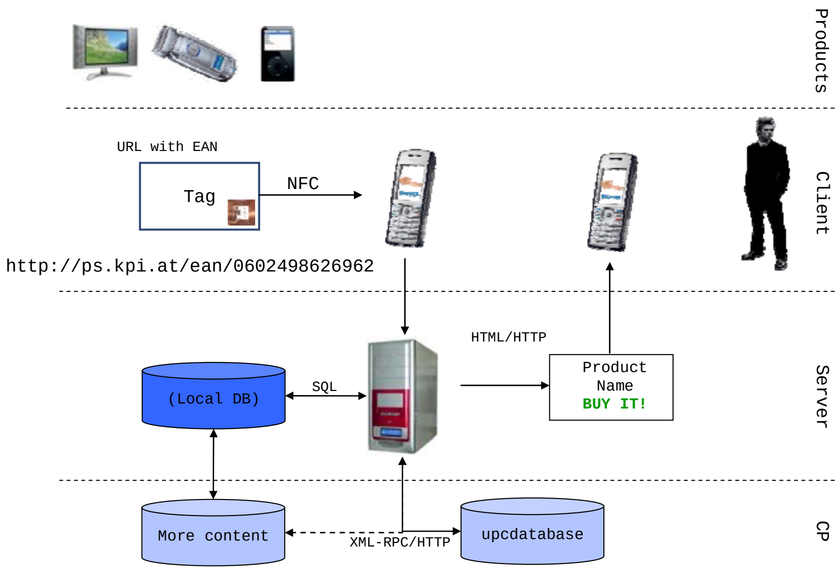

Fig. 1: Mobile prosumer vertical prototype setup

User benefits

The Mobile Prosumer helps consumers to get relevant product information at the Point of Sale. It is currently a service accessible from any mobile phone via a standard WAP/Webbrowser. At the moment we are using NFC enabled phones for scanning RFID to compare with sales assistants approach and EAN barcode recognition with mobile phone cameras. The Mobile Prosumer furthermore aims to aggregate free and paid content from various content sources. At the moment we are still looking for reliable and high quality content partners. Additionally, we are thinking about creating an infrastructure for free independent collaborative content, such as "wikipedia for products". In a next step user management and community filters can be added to personalize content aggregation to increase acceptance.

Contribution to workshop / Open questions

We would like to present the idea and the setup at the workshop. Open questions are: What kind of ecosystem is needed to show the advantages of the application to a broad audience? Which content is relevant for consumers? Which content is suitable for retailers? Is touching allowed in retail scenarios? Is technology irrelevant in shops? What would be a suitable interface design? How to implement the one-click-strategy? Will item-level tagging possibly generate the key ecosystem for NFC? What could be the use case beyond retail setups?
We would be glad to discuss these issues with the audience at the workshop.

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Designing Expressive Near Field Interactions

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ABSTRACT

This position paper describes how methods for movement design, focusing on inbuilt movement and the temporal qualities of interaction, could be especially usfull while designing Near field Interactions, as the inbuilt movement properties of interaction becomes explicit when the designed object loses its focus. Two general movement design approaches are described - to innovate with movement, and to secure performance of flow. Further it is discussed how the performance of movement quality in Near field interactions affects the expressivness of the interaction performer.

Keywords

Near field communication, interaction design, movement design thinking, interaction knowledge

INTRODUCTION

In recent times some focus has been put onto the use of movement as an active part of interaction design research [3, 4]. Currently available computer and mobile technology does hovever not give much room for experimentation with interactions and new ways of experience everyday life. Computer-screen thinking is instead transformed from the desktop onto the mobile devices. New technolology protocols (Such as NFC, Near Field Communication), and innovative peripherals and physical add-ons may however be what lifts mobile life to not just include technologists.

TECNNOLOGY AND INTERACTION KNOWLEDGE

New technologies enables progress, and new materials adds to our design knowledge, but designing do always also include interactions with qualities, which is especially true for physical actions. To simply take inspiration from new techologies or materials have not proven to be a very succesful innovative process. The applications might be new, but the interactions are stagnating, and the innovative potential of such solutions fades and adds to the pile of things that *could* have been great. Interaction knowledge, theory and experience of how to build interactions, should therefor instead be used as that innovation springboard that technology over and over is mistaken to be.

While designing we need to explore the essentials of interactivity, not the essentials of the materiality. The material (technological or not) can serve as a tool for exploring new opportunities, but the interactions themselves are still to be designinged no matter what circumstances. Combining knowledge and experince in interactions *and* knowledge and experince in new materials usually make a solid ground for innovation.

MOVEMENT DESIGN METHODS

In our interaction design practice we base our interaction knowledge on methods and experience of movement. We use a methodology for putting movement in the foreground when inventing, designing or redesigning interactive systems and objects. Two main Movement Design Methods can be said to be Movement Innovation, which is basing designs on prefered movements, and Movement Flow - adapting solutions with movement thinking to gain flow in interactions and similtaniosly more expressive use [5].

Figure 1. Students involved in movement design excercises.

The first method, movement innovation, is a simple tool for innovation. Experimenting with and performing physical movements relevant to the explored use area creates a toolbox of useful interactions which may be tweaked and explored into entierly new objects and services. Performing and experimenting with joyful and pleasureable movements opens up for new and in most cases more suitable interactions than the technology based, push-button, sliding, and clicking ones.

The second method, movement flow, tries to add that extra to interactive objects, existing or in the making, which we do not get when simply basing it on its digital material. Here we map up interaction points, and experiment with new and experimental movemet paths between these points, to come up with new and suitable movement interactions.

Inside out and Outside in

When the technological platform is sat, as when designing new Near Field Commnuication applications, it may be useful to flex between methods for innovation and methods for performance. Finding new applications might lead you to add new functionality, which in itself could be reworked with movement interaction performace thinking and so on.

Working with these methods also involves using your favourite sketching or mock-up techniques, depending on the design situation.

TEMPORAL ASPECTS OF INTERACTION

Even skilled and experienced interaction designers have had a hard time leaving the flat surface thinking when discussing interactivity. A more appropriate way of approaching interaction is to take start in temporal based interaction forms [2], as interaction design is designing time flows – occasions with beginnings and ends.

Action spaces

The concept of the interaction space, or the *action space*, has become relevant when discussing the spatial area that surrounds an interactive object. This area is of course never static, and may change depending on user, but it sets the outer scope of the designers *and* the users view upon the interactive artefact.

Figure 2. Touch, proximity, and interaction space. A mock-up electronic object from the Bricolage Project [1].

This space is of course a concept and does not physically exist, but in NFC applications we actually do have a defined interaction space, not in form but in its outher reach, which may help to grasp these ideas more generally.

DISCUSSION

So, why do we base our interaction knowledge and design methods on movement? Because all interactions are movements performed over time, in all applications, more or less explicitly [6]. We believe that by tweaking these movements we obtain interaction flow in artefacts – easy and functional tools that are joyful to use over time.

The virtuoso guitarist feels flow when playing a guitar solo, he does so because he masters the situation, and he masters his equipment because of the motor-skills gained by experiencing the physical material. We use movement design methods to get simple and playful systems and artefacts with similar inherent flow, to get users who are confident with their tools to the extent that they are able to feel expressive.

CONCLUSION

We belive that new perceptions of Near field interactions may losen up the status que in the developers market of electronic wireless products. Near field interactions may also serve as a vehicle for desingners to think more broadly of temporal and unphysical properties of interaction design objects, because of its inherent intangible qualities.

We see that the concept of Near field interactions (for NFC and RFID technology etc.) may serve as a tool for visualizing the conceptual idea of interaction and action spaces, and at the same time the importance of considering movement and flow within these spaces, when designing and innovating new interactive mobile devices for expressive use.

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Waschsalon

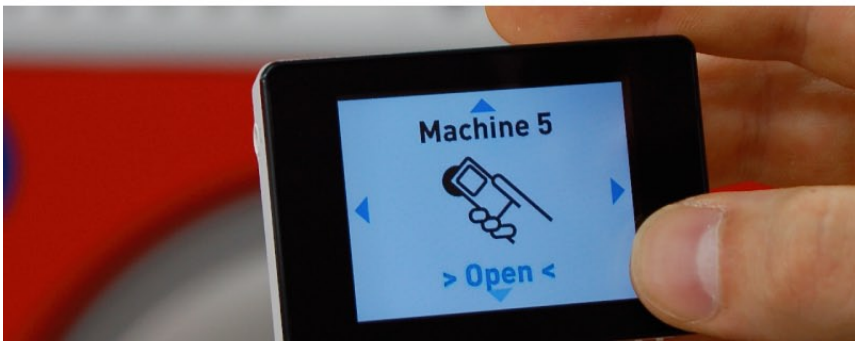
NFC based mobile service for a laundromat

touch to activate

pay

out in a café

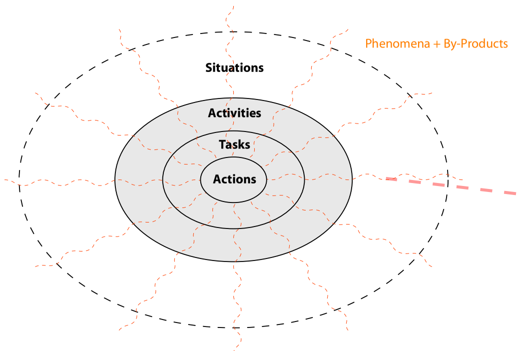
status info

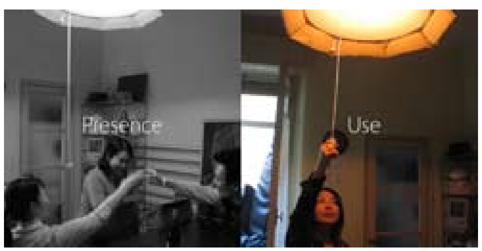


unlock machine

Touch: Near Field Interactions Workshop

Position Paper I Joseph Yang I July 28, 2006





Introduction

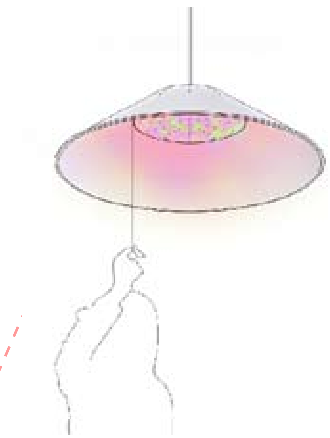
The following roughly summarizes my initial interests in the Near field interactions Workshop at Nordichi 2006. To give a short background, I am a student studying interaction design in at IDI Ivrea/Domus in Milan. Having previously studied industrial design, my interests have often leaned toward questioning the significance, purpose and role of objects in our everyday lives. I am interested in harnessing and appropriating networked behaviors of objects and our interactions with them. In this regard, my view follows a **situation oriented** and activity-centered design[1] where(and when) social and cultural values can be seeded into our everyday lives.

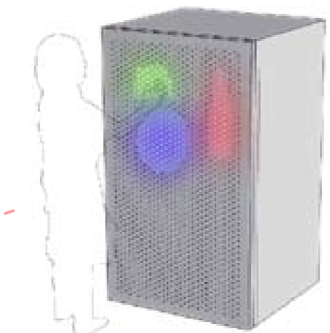
I will try to give a rough idea of my interests and viewpoints through an extremely brief summary of two projects I have worked on in the last year.

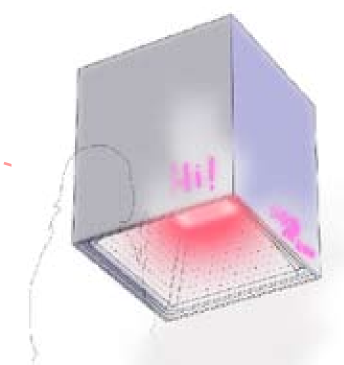
Unconscious Kitchen - Everyday domestic behaviors

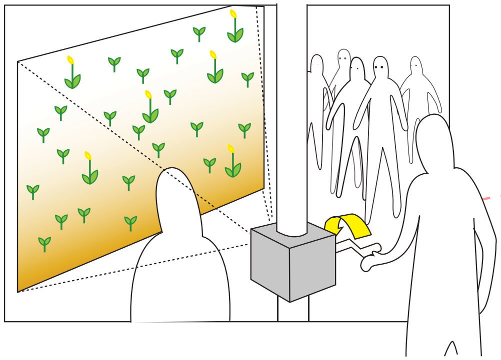
This was a project that explored and questioned what everyday kitchen appliances or objects can do beyond their intended function during the short time we use them. We developed a series of conceptual objects that behaves and lives with people through cycles of their use and presence[2]. One of them was **Chatter Light**— a light over the dining table that offered fragmented memories and glimpses of social moments through unexpected play of sound and light. Some other ideas developed for the project included the **Leftover Fridge** which 'ambiently' displayed forgotten items inside through the façade of the refrigerator. And **Trace Hood,** a ventilation hood that revealed messages during cooking activity through the phenomenon of steam.

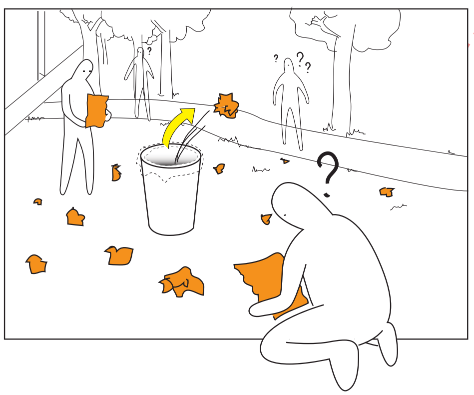
Topics of Interest:
- appliances with specific function augmented with databases and networked behaviors that play with long-term presence and use.
- 'consciousness of objects and their memory during our unconscious everyday rituals and situations (this is very different from pure surveillance where the granularity and type of data shown is carefully trimmed and selected to support playful and social interactions)
- ambient information display (i.e. in the case of Chatter Light, the length of the cord-switch shows the amount of social activity in its memory)











Blackbox - Public Energy Awareness

The primary framework of the project was an investigation on how energy plays a role in urban life. A series of five scenarios were developed to bring about awareness about the value and consumption of energy through technological intervention and engagement. One scenario was **powerBox**, where a lamp on the street invited people to turn its crank and contribute their small efforts to a virtual community. Boxes dispersed around the city are mapped and their collective sustains a communal garden. In **rubbishBox**, a garbage bin 'spits out' symbols of waste in the form of crumpled paper with a message written on it that says 'take me home.' The paper also contains a phone number through which curious people can connect to the network. They then get a message about waste and consumption with a chance to reply to an online community.

Topics of Interest:

- Design of physical interfaces and interactions that become 'tools' for communication and engagement; for questioning and reflection
- Communication of messages through active engagement and interactions
- Networks of objects or touch points in a system/service that enable new social exchange in public spaces

Summary

The two projects I have mentioned deal with two very different topics. One was on domestic kitchen use and experience, and the other, public intervention and communication. An interesting area is the transition between the public and the domestic contexts. How would the mobile phone play a role in this transition as they 'live' with us in our everyday? Which specific physical contexts would be beneficial to 'carry over' data? What kinds of information or social values could the private and public contexts localize and exchange? I would like to explore through this workshop any of the issues/questions mentioned above through analyzing and prototyping some new ideas.

[1] Norman D. Human-Centered Design Considered Harmful. Interactions. CACM (2005).
[2] Hallnäs L. and Redström J. From Use to Presence: on the expressions and aesthetics of everyday computational things. TOCHI 2002, ACM Press (2002).