# PulsArt – IT, Salt and Water For Family Awareness

Recent years have seen a growing interest in considering the domestic household as a new and important domain for interaction design. In this paper we present pulsArt - a physical and digital installation designed for the home to represent different family members' level of activity by water running down blocks of salt based on a real-time reading of the individual family member's pulse. We describe how pulsArt explores novel ways of looking at the interaction between the physical, the social and the digital and how it acts as a context-aware artefact, amplifying the domestic setting to provide a new kind of awareness in the family. In doing so, we seek to develop new perspectives on designing interactive and context-aware systems for the home and what values they might support.

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**INTRODUCTION**

In his article from 2001 "The Design Challenge for Pervasive Computing" [20], John Thackara explores the implications of computing penetrating every aspect of our everyday lives and the growing acceleration of the rate of change in technology. Trying to describe the role interaction design should have in a world where 90% of all chips do not go into desktop computers but into other electronic products surrounding us, Thackara stresses the importance of interaction designers exploring new ways of using technology, where innovation takes the place of pure technological advance (Ibid p. 48). Interaction design should focus on creating *values* in 1) new ways to connect (social computing), 2) in allowing richer and more varied forms of interaction and 3) on creating values emphasizing service and flows (Ibid, pp 50-51). All in all, interaction designers should strive to investigate "…the new relationship [which] is emerging between the real and the virtual, the artificial and the natural, the mental and the material." (Ibid, p. 51)

In recent years, researchers and practitioners have been trying to explore these new relationships. One of the major moves in this respect has been to stop looking at the workplace as the primary domain for design ([9], [14], [17]). Instead, interaction designers seek to access the potential of designing for the *home*. Users at home differ from users at the workplace in that they are not primarily task-oriented. Instead, they engage in activities involving much more subtle and soft values of interaction than mere control and ease of use of interfaces and electronic products in general ([5], [6], [7], [9]). Rather than creating efficient interfaces in terms of control and ease of use, the focus is on creating user *experiences* ([14], [19]), which has led to the development of new design ideas to access this potential by transcending and innovating the work-oriented participatory design paradigm as expressed in [6], [8], [18].

Due to this shift of design context there has been an increased focus on considering the nature of and the values embodied in the digital artefacts designed today and how they might – or should - interact with the physical and social contexts they are designed into. One approach to this challenge has been to make it easier for people to actively experience the technology and its influence on their everyday lives by making the technology more visible and provocative ([6], [17], [18]), thus making it possible for users to actively appropriate the new technologies and the values embedded in them. At the same time, there is a strong tendency towards exploring the possibilities of designing peripheral computational landscapes that do not require focal attention all the time ([10], [13], [15]), but still amplify a given environment using the new technology (10], [23]). These two approaches have been further explored ([18],[22]) as examples of remarkable and unremarkable computing, and exist in many hybrid forms in interaction design today.

In this paper we will describe pulsArt, a digital and physical installation designed to give a new sense of interpersonal awareness between family members in a Danish family, and an artefact designed to take its physical as well as conceptual shape based on its use in the home. We will show how pulsArt is a

context-aware artefact fundamentally exploring the intertwinings of the physical, social and digital space in a domestic setting in modern day Denmark. At the same time we will show how pulsArt is positioned between the two directions in modern day interaction design presented above, both as an instrument of reflection and provocation and as a digital and physical artefact integrated and designed into an existing physical and social context.

## RELATED WORK – CRITICAL DESIGN, CONTEXTUAL INFORMATION AND PERIPHERAL AWERENESS

Before we move on to a more detailed description of pulsArt, we would like to further elaborate some of the practical and theoretical work which has served as a solid background for our work with the artefact. Throughout the design process we have been strongly influenced by the ideas of Anthony Dunne in his book "*Hertzian Tales – Electronic Products, Aesthetic Experience and Critical Design*"[6]. In his book and his design work, Dunne challenges traditional ways of thinking about the socio-cultural dimension of product design and traditional theories of usability and user-involvement. His main idea is, that designers always assign values to the products they make, and he stresses the importance of considering the aesthetics of the social, psychological and cultural experiences the products mediate (Ibid, p. 12) Design is seen as a social commentary, and a critical one where "…design research in the aesthetic and cultural realm should draw attention to the way products limit our experiences and expose to criticism and discussion their hidden social and psychological mechanisms." (Ibid, p. 12) Dunne invokes a way of poeticizing the relationship between people and electronic objects by designing user-unfriendly things, inhuman factors, that provoke us to think about this relationship and the role the electronic objects play in our lives – a user-unfriendliness that reveals the hidden agendas embodied in the objects through a gentle provocation of the users developing what Dunne calls a "para-functional" quality of the products enriching our engagement with the emerging electronic environment (Ibid, p. 43).

While Dunne develops his ideas on a more conceptual level, there is a lot of empirical and practical work related to the idea of using technology to provoke different kinds of awareness between people in numerous ways and contexts by bringing hidden contextual information into play. Peripherally amplifying a workplace setting by visualizing contextual information is explored in the article *Calm Technology* [25] written by Mark Weiser and John Seely Brown as early as in 1995. In this article, the authors describe technology that can shift between both the centre and periphery of human attention. This is "encalming" as opposed to traditional computational technology, which for the most part demands continuous attention in front of the desktop computer (Ibid). Calm Technology is meant to reduce the information overload in our environment, by assigning informational value to a peripheral artefact which can be accessed - or not - in the office environment in which it is placed as an indicator of activity (Ibid). An example of Calm Technology is *the Dangling String*, a cable that starts shaking to display the activity level in a computer network(Ibid).

*Informative Art* [23] developed by Hallnäs, Skog and Redström is another approach to this peripheral information visualization based on computer displays showing artworks, that dynamically reflect their environment. The authors have been working with augmenting artworks and turning them into abstract information displays e.g. by letting Piet Mondriaan-inspired computer displays peripherally monitor the daily e-mail activity in an office (Ibid, p. 4) This Informative Art installation dynamically reflects and therefore in an abstract way represents *information* (Ibid p. 2). The aim with Informative Art is to make otherwise invisible information available in the physical environment as opposed to the virtual thus amplifying the reality through an "... enhancement of expression of artefacts using technology." (Ibid, p.3)

In *"Slow Technology – Designing for Reflection"* [19] Hallnäs and Redström further develop the idea of the computer moving away from the desktop and being integrated smoothly into a designed environment. The new technology is termed "slow technology", because it is "slow" in its appearance and requires reflective use over time to be fully comprehended (Ibid, p. 201). Slow technology does not aim to hide away the technology, but to present it in a way that encourages people to reflect and think about it. It has got to be reflective in its appearance and provoke reflection on its content thus amplifying the existing artefacts and environments and their expressions by the use of technology that aims at a "….smooth integration of digital information and physical space, taking advantage of human peripheral attention." (Ibid, p. 202)

In [13] Heiner et. al. try to develop a new kind of context-aware information display called *The Information Percolator* using bubbles in pipes filled with water to generate near-pixel graphics displaying activity at an office. *Ambient Media* as it is described in [13] by Ishii and Ulmer is an attempt to integrate information displays with architectural space through the development of different phicons, "...making bits tangible." (Ibid, p. 1). Mynatt et. al. have developed their so-called *Digital Family Portraits* [16], where an information display in a home is used to convey information on the health of someone in another location.

## PULSART – DESCRIPTION AND SCENARIOS

After having presented some of the basic work done in relation to our design project, we will now move on to explain our motivation for designing pulsArt leading to a description of the concept and the physical and partly functional prototype we have built. To further clarify the concept, we will present 4 different scenarios describing the intended (and unintended) use of the artefact.

### Background and motivation for design

We are an interdisciplinary design group who have been following a course that is grounded in the research center Interactive Spaces. The course was an interdisciplinary project between the department of design at Aarhus School of Architecture and the department of Computer Science at Aarhus University. In this course we worked with the home as a domain for interaction design. We chose to work with a family of four living in Aabyhøj, a suburb to Aarhus. To gather information about the users, we used domestic probes [6] in a slightly modified way, interviews and pictures (see figure 1). After analyzing these data, we tried to construct a picture of whom we were designing for and what we might actually design based on this picture.

Figure 1
The domestic probes.

We found, that the family was a very active family, with many ongoing physical activities in- and outside of the home, which we would like to highlight. Furthermore, the family had a very interesting relationship with technology purely based on functionality; they had a lot of it, but did not really like it – it was a necessity in their opinion. We therefore decided to design a product that might poeticize the family's relationship with technology. With our design, we wanted to extend the family's conception of what technology might be, making it encompass not directly functional approaches to modern technology. We wanted to try to visualize the different family member's daily activity in- and outside of the household tied to a physical representation on a physical artefact at home, thus provoking a new kind of awareness between the family members. These initial ideas and a lot of design work with the family led to the development of pulsArt.

We will now present pulsArt in content and form, which we will further nuance by a more technical description of the prototype we built and 4 different scenarios showing how we envisage the use of pulsArt in a given family.

**Concept**

PulsArt is a different technological installation for the home designed to display the activity as pulse of an ordinary family. The thought behind pulsArt is that it is a peripheral artefact giving you access to a new kind of awareness about your family. PulsArt creates a presence at home while family members are away and makes it possible for the family members to couple their existing knowledge with an abstract and physical real-time representation on a physical artefact at home. The artefact makes it possible to express oneself at home while away, and it gives the people at home access to otherwise unknown information on the whereabouts of the family members away from the house. At the same time, pulsArt physically changes over time taking a unique form of expression of the family's overall activity. The artefact gets personalized by the family (see figure 2).

PulsArt is a peripheral artefact because it does not require continuous attention from the family. It runs in the background, but can easily be accessed if changes occur – or if you wish to contemplate the changing nature of its physical presentation. At the same time, pulsArt is a very disruptive and demanding artefact that demands a good deal of attention and action from the people in the family.

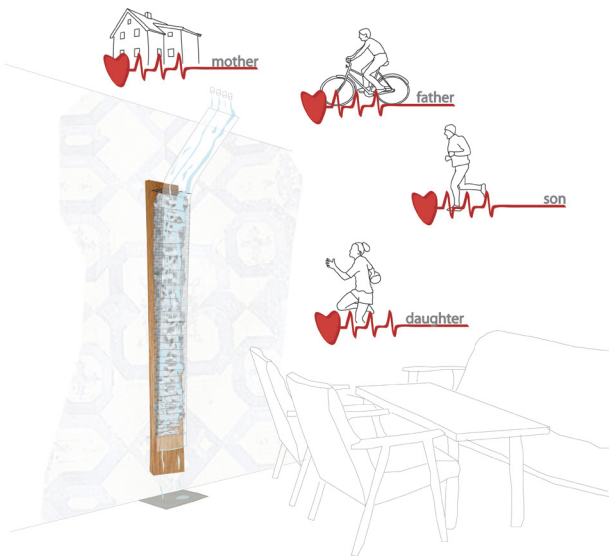


Figure 2
PulsArt concept - the physical installation at home changes over time according to the family members' activity measured by their pulse.

PulsArt is integrated into the family's physical and social context amplifying both. Based on visualizing otherwise hidden information in the context, pulsArt functions as a context-aware and spatial artefact that besides provoking a different kind of awareness between the family members also challenges and evolves their conceptions of what the physical, the social and the digital space is, and how they may interact.

**Form**

PulsArt consists of two major parts: a pulse-meter formed as a ring or a bracelet with a battery and the possibility to send pulse-data in the form of beats pr minute, and a physical artefact at home that transforms the pulse-data into streams of water. Each stream represents one family member and they vary in size according to the pulse of this person: the more beats pr minute, the bigger stream and inversely. The streams run down a piece of glass attached to a wooden backboard and further down reach a number of blocks of salt, that erode and change according to the family's joint activity over time (see figure 3)

The installation is thought to be placed in a room which is used several times daily by the whole family, the social central station (in this case the kitchen/den), and it is supposed to be physically integrated with the spatial surroundings. The physical artefact is thus determined by the space in which it is integrated, in this case by leading the water from its off-spring in the ceiling down the wall to the floor where it is gathered and pumped back to the ceiling.

**Prototype – technical details**

With the purpose of gathering empiric experience with the pulsArt concept and its influence on the surrounding environment we have built a prototype of the physical artefact which is supposed to be placed at home. At the time of writing we have not yet been able to realise the pulse-meter that measures and transmits the pulse. Therefore we have simulated the measuring and transmitting of pulse using a standard pulse meter and a GPRS-enabled mobile phone.

This simulation allows the person whose pulse is to be represented on the physical artefact at home to enter a value representing beats pr minute at an interface on a mobile phone when there is a greater change in beats pr minute. From the mobile phone the data is transmitted to an Internet enabled computer located in the home. Here the data is further transmitted to a BasicX-chip

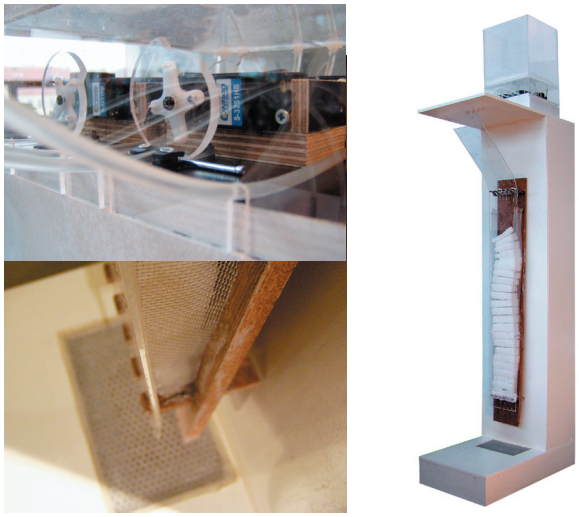

Figure 3
PulsArt prototype - the physical installation for the home

that resides in the physical pulsArt artifact, which receives and processes these data. The beats pr minute of each person is then transformed into a signal, which controls the circular movement of one of in all four electromechanical servos, each representing one person. The servos are all equipped with a circular disc whose radius is gradually increased by which the circular position of the disc determines how much it squeezes a thin piece of tube. The circular position of the disc thereby determines the amount of water allowed to run through the tube and down the glass; the higher pulse, the more water and inversely. (see figure 3, top left picture)

**Scenarios**

We will now present how we envisage the use of pulsArt in four everyday situations at home through four scenarios of use. In these scenarios, pulsArt is placed in the fictional Madsen family, consisting of the parents Carsten and Birgitte, and the two children Jens and Stine. For means of highlighting some of the qualities of pulsArt, the Madsens are to be seen as a somewhat stereotypical family.

*Scenario 1 – pulsArt provoking a thought of affection*

It is almost five o'clock, and Birgitte has just returned from work. She prepares a cup of coffee, sits down on the coach and starts reading a magazine. At a quarter past five a stream of water in pulsArt starts running faster. Birgitte looks up and it reminds her that Stine is practicing handball right now. She smiles knowing how much her daughter enjoys it. (See figure 4)

*Scenario 2 – pulsArt provoking an action.*

Later that evening at a quarter past six, Carsten has finished work. He gets on his bicycle and heads home. As his pulse rises, his stream of water starts running faster at home. Birgitte sees this and goes to the kitchen to make dinner, because she now knows Carsten is on his way home. (See figure 5)

*Scenario 3 – pulsArt provoking reflection*

After finishing dinner, Carsten and Birgitte are sitting in the couch relaxing. Suddenly Jens' stream of water starts running faster and faster, which makes the parents wonder what he might be up to. When Jens gets home, they ask him what he has been doing. He tells them, that he tried to catch a bus by running as fast as he could, but that he missed it. (See figure 6)

*Scenario 4 – pulsArt provoking ludic activities*

Jens and Stine get together in front of pulsArt to look at the eroding salt. Suddenly, Stine starts jumping around thus making her stream run faster. Jens immediately starts doing the same thing, and the two siblings have a competition to see who can make his/her stream run faster than the other. (See figure 7)

These four scenarios all illustrate different sides of the possible everyday use of pulsArt in a somewhat idealized but nonetheless illustrative way. The first three scenarios show how existing knowledge and the abstract representation on pulsArt act as both an affirmation of a presumption (scenario 1), as a cause of action (scenario 2) or provoking reflection and discussion (scenario 3). The fourth scenario shows how the family members are able to hack pulsArt in an unintended but possible way.

**FUNCTIONALITY ISSUES**

After having presented the ideas behind pulsArt, its present form and some intended scenarios of use, we will now discuss some pertinent functionality issues when designing the artefact in order to further develop some perspectives on our work with the concept.

**Pulse as activity**

Our intention with pulsArt has been to provide a new kind of awareness amongst family members based on a reading of the individual family member's level of activity. In the design-process we have discussed which kind of sensor or combination of sensors would be most adequate for measuring the activity of the family in the best way. Measurements of exact positions with GPS or movement from one GMT cell to another were two possibilities to measure activity when moving outside. These possibilities could be easily implemented using a mobile phone or PDA with the proper technology, but they were quickly

Figure 4
Scenario 1

Figure 5
Scenario 2

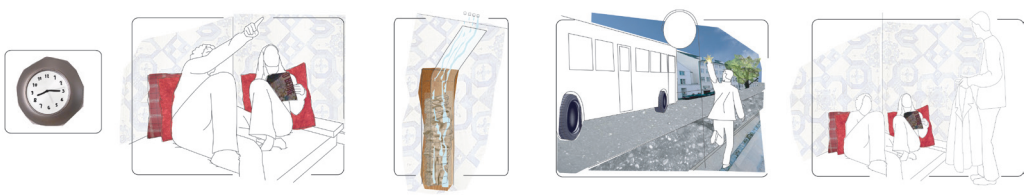

Figure 6
Scenario 3

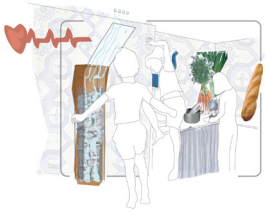

Figure 7
Scenario 4

scrapped because indoor activity, e.g. playing handball at the local sports-centre or walking around at work, would not be measured. This led us to further considering accelerometers and pulse-meters, of which we chose the latter because of its close and organic mapping to human activity. Indeed this technology has its limitations too, as its main focus is on physical activity, and because of several other considerations in terms of pulse activity versus fitness (the less fit you are, the higher pulse, the more "activity" on pulsArt.).

**Abstract representation vs. readability**

One of the recurrent questions when designing pulsArt has been how to represent the measured activity in an abstract yet readable way. As such, the question has been one of functionality – you would have to be able to actually couple the abstract representation with your existing knowledge, in order to "use" pulsArt in the intended way. On the other hand, we have tried to move away from the technological paradigm of efficiency, ease of use and pure functionality, to access more subtle values of interaction at home. Even though the streams of water representing the individual activity of the family members are based on a real-time reading of the pulse, they are also an abstract expression of it. We have thus tried to represent the activity in a very abstract manner, where it is e.g. not possible to see the accumulated activity of each family member in the salt-display, this being a stated wish from a daughter in the family with which we have designed pulsArt. This abstract representation of activity makes pulsArt a reflective technology that might lead the family and their guests to moments of reflection when interpreting the streams of water which further distance pulsArt from more functionally information systems in terms of efficiency. All in all, we have tried to make the representation as abstract as possible, while still retaining the ability to interpret it in a useful way.

**Surveillance or awareness?**

PulsArt is designed to provide information on the family members in a way that might suggest it to be used as a type of surveillance by one family member in order to make sure other family members were not doing anything they should not. However, pulsArt is only a very abstract representation of the activity of each of the family members – when looking at pulsArt you only get hints as to what might be going on, not any direct answers, which is a crucial part of the design. Furthermore, there is a symmetrical commitment from all of the family members, as mentioned in [22], where it is stated about Informative Art, that "...everyone contributes with and have access to the same amount and kind of information."(Ibid, p. 8)

Another very important point is hackability. We believe that pulsArt provides many possibilities to actually break its intended use patterns. As described above in Scenario 4, pulsArt might function as an occasion to ludic engagement. Or you might decide to lend out your ring/bracelet measuring the pulse to one of your friends, or an animal of some kind. The physical installation at home is also hackable – you can scratch the salt, pour more water onto it to "fake" the general activity level.

## FORM – GIVING DIGITAL DIGITAL INFORMATION A PHYSICAL EXPRESSION

While e.g. Informative Art focuses on how traditional art objects can be amplified to display information, pulsArt primarily focuses on how to create a new context-aware, physical representation of digital information. PulsArt translates the activity of the family outside the home into physical traces inside the home in a real-time representation displayed on a physical artefact. Furthermore, the artefact accumulates the information by leaving long time traces in the salt and taking on its own individual form, according to the family's level of activity over time. Physical form, materiality, spatiality and the conceptual ideas underlying the design have mutually influenced each other in the realisation of the final artefact. In this section we will present the dynamics of these reflections and moves in the design process.

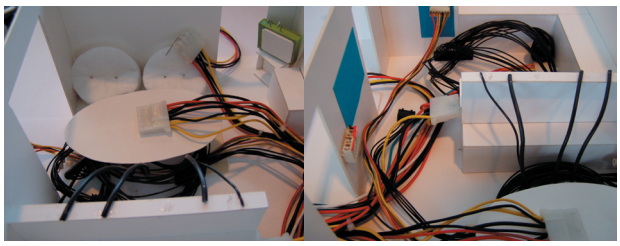

Figure 8
The model in which we analysed the space and spatially displayed pre-existing patterns of movement to get a better understanding of the existing space into which we were designing.

**Spatially placing pulsArt**

Whereas working with the conceptual foundation for pulsArt we have been greatly inspired by the work of Dunne and his thoughts of gentle provocation, the concrete design has been carried out from a more architectural point of view. Working on giving pulsArt a physical form that supports this has been an iterative process, where we have worked through sketching, building models and material experiments. Finding out how to place pulsArt in the home, we decided to place it in the social centre of the home, the kitchen/den. Most communication within the family members and "family-time" was spent around the kitchen table. We therefore analysed the space through a model displaying the pre-existing patterns of movement to get a better understanding of the existing space in which we were working (see figure 8). The space, in which the artefact is placed, has an impact on the physical design of the artefact. At the same time, the spatial experience of the room will be affected by the artefact, the patterns of movement in the existing room might change and new ones will be created. For us, it has been very important to spatially place pulsArt within the home, so that the physical boundaries and the physical artefact can mutually influence each other. The physical shape of the artefact is as such a very concrete answer to the context into which we were designing.

**Bodystorm – physical brainstorm at home**

To kick start the design process and as an attempt to activate the family directly in the design process, we decided to do a bodystorm – a physical brainstorm in the home of the family. The term bodystorm is derived from the design firm IDEO. IDEO primarily work with transforming the design space into the context into which they are designing to "…delineate different types of consumers and act out the roles."[21]. Instead of acting as the family members and guessing on their thoughts and needs, we decided to "invade" their home and build onsite

Figure 9
BodyStorm - A physical brainstorm in the home of the family.

mock-ups of pulsArt in the physical room into which we were designing. We saw this as a possibility to include the family in the design process thus making them reflect on their home in a different way and giving the family members an opportunity to quickly give their ideas a physical form. Even though we came with a conceptual proposal to frame the bodystorm, it was the family members themselves that were to physically design them. The workshop gave us some concrete design ideas to work with (see figure 9), out of which we chose one to work with that met the criteria below.

**Real-time and long-time expression**

PulsArt is designed to display the long-term changes over time in a physical artefact the family can see, touch and influence, as well as a real-time individual level of activity. The first is displayed as the water erodes the salt over time, the latter through the level of water running down the salt from the individual nozzles, displaying the individual family member's activity right now (see figure 10). These two separate elements created different demands on the design of the artefact. It was important that the water running down was visible from the whole room at all times for the information displayed to be peripherally visible. The accumulated activity did not necessarily have to be seen at all times, which is why it was placed alongside the wall as opposed to the water coming out of four nozzles in the ceiling.

**Activity displayed in salt**

The decision to work with salt as representing the physical accumulation of the family's activity was generated through the idea of the family setting physical long-term traces on the installation over time. Knowing that our concept in itself and the physical installation to be placed in the home would be very alienating for the family, we decided to make the physical appearance of pulsArt more familiar, using known and aesthetic materials, such as asobé, glass and salt. Instead of introducing new materials in the home environment, we tried working with reconfiguring familiar materials that already existed in the home. After deciding on designing pulsArt using salt as the indicator for the family's joint activity, we fond that even though salt and water both are to be found within the home, they are not easily controlled. How fast was the salt going to erode? How could we get the salt block to erode smoothly? These were some of the questions we wanted to answer. We also moved away from the idea of using one big salt block. Instead, we started using several smaller salt blocks, which also made it possible to easily refill pulsArt with salt (see figure 11).


Figure 10
PulsArt - the physical installation for the home where the level of water running from the individual nozzles, displays the individual family member's activity in real time(1) and the joint family activity level is displayed as the water erodes the salt over time (2).

Figure 11
Experiments with salt.

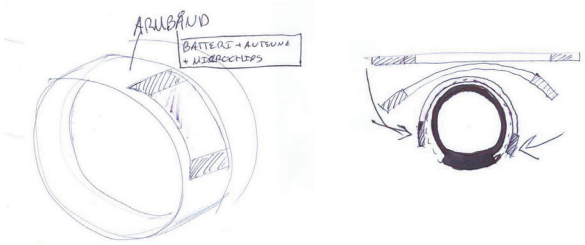


Figure 12
Sketches of the pulsemeter as either a bracelet or a ring.

**The pulse-meter – outlines for a design**

The primary focus of our design process has been on designing the physical artefact for the home. The pulse-meter has only been developed on a conceptual level due to its time-consuming and technologically demanding form and content, but it plays a crucial part of the realisation of the concept. The family members have to wear their individual pulse-meter at all times. Therefore the pulse-meter must be designed to be a non-disruptive element for the person wearing it. Through sketching, we have tried to visualize how it might be designed. The pulse-meter takes the form of either a ring or a bracelet. It consists of an OLED screen which can be clicked on or off to complete its form, a battery and an integrated transmitter (see figure 12). The ring/bracelet starts pulsating, when a change in the pulse is sent to the artefact at home, informing the family member that information is being passed on to the family at home.

**DISCUSSION AND PERSPECTIVES**

After presenting both the concept of pulsArt and some of the reflections surrounding it, we will now try to discuss these issues in connection with our theoretical and practical background. In doing so, we hope to show how we have tried to develop these ideas into a novel way of physically expressing the activity of a family using IT, salt and water.

**Designing for the home – remarkable vs. peripheral**

First of all, we find it important to stress that we have been designing for the *home*. The form and content of pulsArt has been shaped by the family with which we have been designing. Furthermore, we have been working with a family, whose conception of what technology might be has been a major issue in the making of pulsArt. We have explicitly tried to couple the physical and social with the technological in a way that transcends the family's vision of what technology is and can do. As such, pulsArt is an example of remarkable computing [17] or critical design [6] in the way, that it is an artefact that basically

questions itself and the values it incorporates and therefore forces the family to reflect upon it and the role these new kinds of technology might play in their everyday life.

On the other hand, pulsArt is designed to be able to fit spatially and physically into the family's home. The form is a result of careful considerations of what might function with the existing physical and social environment. Therefore we also hope that pulsArt over time might find its place as a natural part of the home as a peripheral artefact that does not continuously obstruct the family members focal activity, as expressed in the ideals of Calm and Slow Technology ([10], [25]).

**Physical expression vs. information displays**

Another important aspect of pulsArt is the focus on giving the digital information processed a *physical expression*. Instead of working with displays ([25]), we have been working with displaying contextual information on a physically embedded *physical* artefact. The real-time representation is streams of water, the evolution over time is traces in the blocks of salt – what the technology does, is to translate the pulse-information (physical) into bits (digital) which are then translated into physical expressions in the installation at home, which provoke a different social awareness. We find this an area worth further exploring, thus bringing forth a reflection on the possible transitions between the physical, the social and the digital.

**Personalized and context-based expression over time**

PulsArt is designed to take its shape and meaning through use over time. It is important to notice here, that we have tried to add an additional layer of information to the real-time expression presented in e.g. [24] and [12], where the displayed algorithms only function until the system is restarted. PulsArt provides physical traces and evolves according to the family's level of activity over time this being one step towards making pulsArt more individualized and personalized for the family who owns it. This openness in expression is further enlarged by the way you are able to hack pulsArt.

Having completed a functional prototype of the physical installation which is to be placed in the home, we also see some possibilities in the way this installation might actually acquire a life of its own, making it a very personal artefact with its own habits, moods etc. But this needs to be tested in a real life setting, why we find it very important to further develop and realize the concept of pulsArt so it can be implemented in a family. Only by doing this will we be able to truly explore its effect on its surroundings and how the two might interact over time.

**Future work**

Even though our work with pulsArt has resulted in a partly functional prototype and a lot of interesting reflections on its possible use, we are aware that the only way to fully test both the functionality and the poetic abilities of the artefact would be to implement it in the family's home to study its use over time. But even if this had been possible, evaluating the artefact would be a complex matter. As expressed in e.g. [24], traditional methods of evaluating design do not take into consideration the more reflective or poetic capabilities of an artefact. Evaluating the usefulness of pulsArt would need to focus not only on whether the artefact is usable or aesthetically pleasing to the family, but also whether it actually does make them reevaluate their basic presumptions about what technology is and can do, which, to say the least, is a rather complex matter.

Besides from actually realising the artefact, we have also considered using the basic idea of using a digitally amplified physical installation to display activity in a different context than

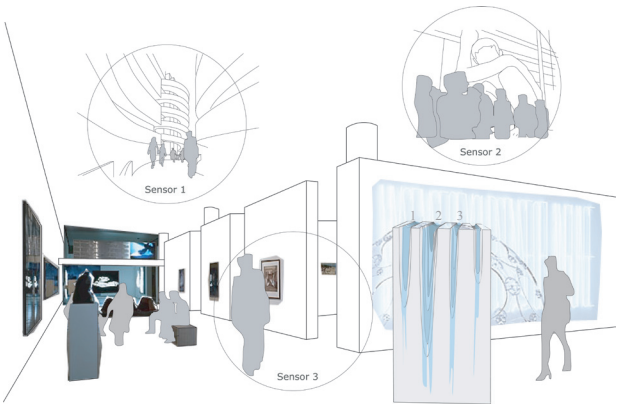


Figure 13
PulsArt at the art museum Aros. The sensors measure the activity at the museum and the level of activity is then displayed in PulsArt.

that of the home. In fig. 13 we have tried to visualise how pulsArt might evolve into a public artefact, displaying the activity in an art museum using sensor technologies, digital processing and physical erosion. This, of course, would require a new design process when it comes to reconfiguring both form and concept.

## CONCLUSION

In this paper we have presented pulsArt, a physical and digital installation for the home which seeks to poeticize the relationship between the digital, the physical and the social contexts who meet there. It is an artefact meant to provoke a different kind of awareness between family members by giving access to abstract information on their individual activity in a real-time expression of their pulse level as streams of water, and by providing a medium which might evolve over time with the family according to their joint activity, expressed as erosions in a number of blocks of salt. It is a contextually based information installation trying to open up the path for new ways of thinking what a display might be like, and what information might be displayed in interactive systems in a domestic setting.

We further believe that pulsArt is an example of an exploration of both the ideal of remarkable and unremarkable computing. In the outset, it is a provocative end poetic digital and physical installation supposed to challenge the family's conceptions of technology and its role in their home. At the same time, the idea is that the artefact might evolve with the family through time, and acquire a life of its own smoothly integrated into the family's daily routines. We find that pulsArt opens the possibility for studying this dynamic in an interesting way.

PulsArt is an attempt to rethink the role technology might play in our future homes. As such, it is an exploration of what values it might support as an artefact in itself. Perhaps it is best thought of as what Gaver et. al. [9] call a pre-genre artefact, designed to be fairly easy to use but difficult to interpret (Ibid, p. 899). To gain knowledge on this interpretation, pulsArt needs to develop into an artefact that is ready to live in a home. Then we will be able to explore the aesthetics of use it might entail and what values pulsArt actually supports.

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