Designing for IoT Multi-Touchpoint UX

Dimitrios Gkouskos
Malmö University/K3
Internet of Things and People Research Center
dimitrios.gkouskos@mah.se

Per Linde
Malmö University/K3
Internet of Things and People Research Center
per.linde@mah.se

Experience Design for Multiple Customer Touchpoints workshop in conjunction with NordiCHI'16. October 23-27, 2016, Gothenburg, Sweden.

Abstract
In this paper we discuss designing for multi-touchpoint experiences through the case of Internet of Things (IoT) design. First we outline the challenges of balancing implicit and explicit interaction, supporting the configuration and personalization, and providing learning opportunities for users. We then propose that it is necessary to define design tools that can support experience design by focusing on active user involvement in order to fit designs into the user's daily lives.

Author Keywords
Internet of Things; Experience Design; Design Process; Multi-touchpoint design.

Introduction
The issue of multi-touch point experience design cuts across the fields of service design, interaction design, product design and omnichannel design. This becomes even more pertinent considering the increasing complexity of new products and services that entangles a variety of accessible services into the physical body of an artifact. Such augmentation is often found in the field of pervasive computing and especially so in the expanding field of Internet of Things (IoT). As IoT based products most often rely on services attached to them, users navigate through a myriad of touchpoints,

Proposed Method

***Technology Probes**:*
Technology probes is a user research method that makes use of an open-ended technological artifact in order to collect user data while also involving users in the design process. Hutchinson et al. (2003) describe technology probes as a method that can help determine what kinds of technologies would be interesting to pursue. This is especially relevant to IoT research since new technologies are constantly introduced in IoT. Technology probes fit well into multi-touchpoint IoT UX as they steer designers away from black-boxing and monolithic designs, and instead allow for the user's direct involvement in the design process.

digital as well as analog. Even though the smartphone has arisen as a standard hub for UI based interaction, we find that screen based interfaces are not necessarily an ultimate solution for these products and services. Further, as the technology becomes popularized, it is also used differently by various types of users. IoT based products and services must offer a variety of touchpoints as to be able to address the socio-material conditions of use. Taking IoT based products and services in domestic settings as a starting point, our research explores these issues and in this paper we aim to discuss the following research question:

-How can we understand and design for the multi-touch point experience of IoT based computing?

In doing so, we try to address some central opportunities and challenges for multi-touchpoint experience design through the case of IoT design, as well as suggest approaches for designing multi-touchpoint experiences.

Issues on ideals, handles and meaning-making

Andreas Lundh accounts a story from a movie by Jaques Tati and a scene where a man tries to express his anger through slamming a door shut hard. As the door has the peculiar property of being silent, no sounds occur despite several attempts [8]. The intention is to discuss challenges relating to design of intangible artefacts whose use also depends on material properties and users' opportunities to express themselves individually. This expression can also take place in contexts that go far beyond the designer's appreciation of the use situation. Expressing anger is not inherent in the design of doors, but rather an example of how skilled people are making use of the border resources of things and artefacts. From this perspective the story highlights some potential challenges for user-centered design and the ideals of "ease of use", smoothness and seamless experience. The simpler the means for operating the door is, the less explorative it is from a use perspective. Continuing with the door metaphor we now have the self-revolving door. Relying on sensors for detecting when it should open, the monolithic design becomes even more apparent; you should just walk through, there is no need for any handles at all. Following this line of thinking we can then observe how autonomous system behavior deprives users of the control provided by explicit interaction. On the other hand, having to take decisions in a world full of forking paths would call for an unbearable situation. Chalmers and Galani, proposed the concept of "Seamful interweaving" and take a stance for heterogeneity [2]. It is highlighted how a narrow design focus on one tool, medium or interaction as being primary disrupts the heterogeneity of everyday life. Exploring multi-touch experiences therefore becomes a crucial issue for the context of domestic computing. A specific take on that question and a first issue to address here would then be;

-how can we design for a good balance between implicit and explicit interaction in different ecologies of touch-points?

We have elsewhere criticized the strong ideals dominating IoT development to hide technological complexity in "black-boxed" designs [9]. By leaving the hardware and software open for configuration, it provides scope for tinkering to occur and for learning about IoT, as well as the possibility to inspect system

Proposed Approach

Contextual Inquiry: Contextual inquiry is a well-established participatory design approach that "helps people crystallize and articulate their work experience" [1]. Beyer and Holtzblatt [1] describe that the approach has the guiding principles of: *observing* use in *context, forming* a partnership with the user, striving for an authentic *interpretation* and keeping *focus* on a specific research aim. Contextual inquiry offers a specified way to empathize and understand user experience including instances of implicit interaction and examples of appropriation of technology that may have slipped through the cracks of a more clinical approach to user research.

behaviors. In this sense, many scholars have also promoted the possibilities for users to reconfigure design (for example Galloway et al.[6] reflecting on design for hackability or Chalmers et al. who put forth design-for-appropriation as an ideal [2]. This leads us to highlighting a second issue/opportunity;

-how can we design for promoting configuration and personalization in multi-touchpoint systems?

A final attachment to the above two articulated issues related to meaning- making. The above listed issues on invisibility, black-boxing and monolithic designs do not promote learning of products and services among the average user. Paul Dourish, in a seminal book, discusses the aspect of meaning making in interaction with digital systems [4]. He argues that the meaning of interacting with a specific touchpoint is not determined beforehand by the designer's pre-understanding of rationality, but it emerges in the actual use situation [4]. Therefore, meaning-making relates to the learning potential that is provided by the use situations. Learning and smoothness in experience do not always go hand-in-hand, since for learning to take place, reflective interruptions in the flow of actions should also occur. For the design of multi-touch point experience a question arises:

-how can we promote learning in interaction with products and services while still offering experiences that can be perceived as coherent?

The issues of balancing implicit and explicit interaction, configuration and personalization, and learning are central to multi-touchpoint IoT experiences. These issues provide challenges as well as opportunities for us designers, some of which relate to methodology. Before proposing design tools with potential for addressing these issues, we will in the next section review some of the related work on the issues we have raised.

Related Work

IoT technologies offer opportunities to inject new types of automation into the user's everyday life. However, designing inflexible black-boxed systems that automate seemingly mundane everyday tasks may cause more problems than provide solutions. Yang and Newman studied the Nest thermostat [11]. Nest is advertised as a smart thermostat, capable of learning from the user's behavior and adapting interior climate accordingly. The study findings showed issues with the system failing to understand the user's intent, and the user failing to understand how the system works, thus making it almost impossible to teach the Nest to behave in a desired way. Instead of automation easing the user's life, the study participants reported feeling loss of control as the Nest's black-boxed, opaquely designed automation took over. One reason for the Nest's shortcomings is the designer's limited understanding of the situated, contextualized use of the product, due to focus on lab studies instead of real world long-term experiences [11]. Fischer et. al [5] further this point by underlining the importance of indexicality in IoT user data; that is, data is not independent of the circumstances of its production. A solution is for user research to be approached in a holistic manner in order to improve our chances of empathizing with the user. One such approach is proposed by Crabtree and Tolmie [3]. By closely documenting home life through an ethnomethodological approach, these authors uncovered patterns of human interaction that involve - not singular products- but constellations of things that

Proposed Method

UX Curve: The user experience curve is a retrospective user research method aimed at reconstructing the user's experience over time [7]. Users are asked to draw a timeline of negative and positive experiences. A paper sheet with two axes drawn is used for the UX curve. The vertical axis represents experiences from negative to positive, and the horizontal axis represents time from learning about an artifact to today. The UX curve helps users represent experience over time, and therefore the method is well suited to capture appropriation of an artifact over a longer period of time.

come together to support an activity often tied to a particular place in the home.

These findings reinforce the problematic nature of monolithic design, where the designed product may be hard to fit in a user-generated configuration of artifacts. Finally, participatory design approaches may have a lot to offer to multi-touchpoint UX design. A participatory design approach can inject users' knowledge throughout the design process [10] by raising the status of users as that of active participants in the design activities.

Proposed Tools

In order to better support a coherent multi-touchpoint IoT UX we believe that it is important for designers to involve users in the design process in a meaningful way. As a kick start for the methodological discussion, we provide examples design tools in the form of design methods, approaches to design, and design ideals that we believe are suited for multi-touchpoint UX design, in the boxes to the left of the paper's pages. This is by no means an exhaustive list of tools but it is rather meant to be a beginning for a discussion on what tools can design teams use to work with multi-touchpoint experience design.

Discussion

The methods listed above are meant to exemplify the kind of design aids that multi-touchpoint experience designers should aim to use. Drawing from participatory design, ethnomethodology, and co-creation, we propose that successful multi-touchpoint design processes must not focus on technology but rather on the common denominator, the user. While the touch-points and the context may change, users remain at the center of the experience. We believe that involving users in the design process with participatory design methods will foster empathy and a deep understanding for the place that technology should have in the user's life. Thus we suggest that in order to solidify multi-touchpoint UX, the research community must have a discussion regarding design methodology that can support both IoT experience and multi-touchpoint experiences in general.

Conclusion

The field of Internet of Things is indeed promising; the possibilities to improve everyday life by using technology in thoughtful ways that support human activities are endless. However, the challenges that come with working in such an interdisciplinary domain need to be dealt with. In this paper we outline several challenges we foresee when it comes to the design of IoT experiences.

We have motivated why balancing implicit and explicit interaction, supporting the configuration and personalization, and providing learning opportunities for users are important challenges that must be addressed if we are to succeed in designing for desirable experiences. We believe that the approaches, methods and tools used in the design process can heavily influence design outcomes; on one hand, these design artifacts can support designers and users in co-creating engaging desirable experiences, and on the other hand they can reduce users to a set of variables that barely represent the realities of everyday life. Multi-touchpoint UX design is young enough to afford the possibility to lift users to their rightful place. As they are co-creators and recipients of the final experience, we can use the design process to enable user participation and thus

create delighting multi-touchpoint experience designs that are sensitive to the intricacies of everyday life.

Acknowledgements

This research is part of the Internet of Things and People research center platform and financed by the KK foundation.

References

1. H Beyer and K Holtzblatt. 1997. *Contextual Design: Defining Customer-Centered Systems*. Elsevier Science.

2. Matthew Chalmers and Areti Galani. 2004. Seamful interweaving: heterogeneity in the theory and design of interactive systems. *Proc. DIS 2004*, August: 243–252. http://doi.org/http://doi.acm.org/10.1145/1013115.1013149

3. Andy Crabtree and Peter Tolmie. 2016. A Day in the Life of Things in the Home. *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing - CSCW '16*, ACM Press, 1736–1748. http://doi.org/10.1145/2818048.2819954

4. Paul Dourish. 2004. *Where the Action Is: The Foundations of Embodied Interaction*. http://doi.org/10.1162/leon.2003.36.5.412

5. Joel E. Fischer, Andy Crabtree, Tom Rodden, et al. 2016. "Just whack it on until it gets hot." *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16*, 5933–5944. http://doi.org/10.1145/2858036.2858518

6. Anne Galloway, Jonah Brucker-Cohen, Lalya Gaye, Elizabeth Goodman, and Dan Hill. 2004. Design for hackability. *Proceedings of the 2004 conference on Designing interactive systems processes, practices, methods, and techniques - DIS '04* 199, 37–40: 363. http://doi.org/10.1145/1013115.1013181

7. Sari Kujala, Virpi Roto, Kaisa Väänänen-Vainio-Mattila, Evangelos Karapanos, and Arto Sinnelä. 2011. UX Curve: A method for evaluating long-term user experience. *Interacting with Computers* 23, 5: 473–483. http://doi.org/10.1016/j.intcom.2011.06.005

8. Andreas Lundh. 2003. Massification of the Intangible: An investigation into embodied meaning and information visualization.

9. Anuradha Reddy and Per Linde. 2016. The Role of Participation in Designing for IoT. Proceedings of DRS 2016, 1–13.

10. Clay Spinuzzi. 2005. The Methodology of Participatory Design. *Technical Communication* 52, 2: 163–174. http://doi.org/10.1016/j.infsof.2008.09.005

11. R. Yang and M. W. Newman. 2013. Learning from a Learning Thermostat : Lessons for Intelligent Systems for the Home. *Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing (UbiComp 2013)*: 93–102. http://doi.org/10.1145/2493432.249348