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Experiential Probes: probing for emerging behavior patterns in everyday life

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Abstract: With the rise of highly interactive and intelligent product-systems it becomes increasingly more difficult for design researchers to understand and predict the impact, meaning and value of their designs for society. As the meaning of these products is often created in interaction, design researchers learn about their designs, and the user acceptance or rejection, only after product launch. Valuable insights and inspiration for design researchers are not incorporated in the design process, but come as an afterthought. Probing is a useful technique to inform and inspire design researchers, allowing them to gain early insights in their designs. The nature of most probing techniques is to record, analyze and understand current 'static' situations (i.e. ethnography), and to obtain information or inspiration for design researchers. Recent technological developments offer opportunities to probe in 'dynamic' i.e. changing or emerging, situations, and to merge analysis with design synthesis. This conceptual paper discusses different probing techniques through their fundamental characteristics: informing, inspiring, observational, experiential, static, dynamic etc. We further argue that 1) it is logic that probes with different characteristics fit different phases of the design process 2) dynamic, inspiring, Experiential Probes are more desired when initiating innovation for societal transformation.

Key words: design probes, Experiential Probes, innovation, societal transformation, Experiential Design Landscapes

1. Introduction: probing and design research

Design researchers are inherently interested in studying the design context and the people in it i.e. their everyday life, culture, needs, thoughts, values etc. Different traditional (ethnographic) methods can be used to gather such information e.g., contextual inquiry [11], observations and interviews, but also with marketing/market research techniques e.g., focus groups and questionnaires. In design research, observation in the field is typically done in a naturalistic setting and aims to inform the early stages of design. Design researchers follow what happens to their design in context; how people understand it, make sense of it, talk about it, and learn to use it [15]. Design researchers can also engage with users by involving them in the innovation and product creation process [27] through participatory design [24], co-creation [23] and empathic design [16].

Probes have been recognized as a useful tool to inspire and to inform design researchers, to create dialogue with users and to support user participation, allowing them to gain earlier insight in the design process. Starting from cultural probes [5] as forerunner, more probing tools have been developed including Experience Probes [2], Empathy Probes [17], Informational Probes[3], Technology Probes[14], Domestic Probes[6], Mobile Probes[12], Urban Probes[22] and Experiential Probes[21].

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Graham et al. (2007) describes how probes work and what they can do for (design) researchers, regardless of the reasoning behind or the aim of the project [9]. Matthews and Horst (2008) executed taxonomy on probes research, in particular the interpretation of the probes, and how these contribute to knowledge generation. Boehner et al. (2007) examined the uptake of probes and their value for the design research and HCI community by focusing on alterations on the original concept of (Cultural) probes and resulting epistemological questions. Hemmings et al. (2002) examined the deployment of probes for inspiration and information [10]. Probes have been used in (design) research for many varying reasons, purposes and in different contexts.

2. Reasons to probe; acquire, inform, inspire, dialog, user participation

Mattelmäki (2006) describes four motivations to apply probes in design i.e. inspiration, information, dialogue, and participation, and how these influence the direction and possible outcome of probes. Some probes aim to acquire inspirational responses and data about people's lives, values and thoughts, to stimulate the design researchers' imagination [5]. Others aim to inform the design researchers early in the design process [3], or to involve the user more closely through dialog or participation in the design process [14, 22, 24].

The bottom line of research with probes, and their inherent qualities, is that the probes capture 'data' (e.g., individual, social, and environmental data) that can feed/support the design process [18], but still provide a high fidelity and rich characterization of the people in/and the design context [5]. Probes are preferably deployed in a naturalistic setting [4] and are sensitive to the (ecological) richness of the design context and the people. Probes are preferably design-driven aimed at designing with people (as opposed to designing for people)[26]; they can facilitate an exchange between design researchers and the people being probed [24]. Probes are therefore often not a finished product or solution offering but merely design concepts or a research vehicle to learn more about people's life, culture, needs, choices, behavior, thoughts, values etc. With some probing techniques the emphasis is on probing real-time, together with people; other probing techniques probe longitudinal, asynchronous (afterwards), remotely, and merely record or observe.

3. Probing

According to the American Heritage® Dictionary the definition of probing is "an exploratory action or expedition, especially one designed to investigate and obtain information on a remote or unknown region. It is the act of exploring or searching with a device or instrument (i.e. a probe)...in order to find of discover something."

Probing is a design-oriented user involvement and research technique based on in-situ recording and documentation of users' experiences, feelings, attitudes and values by purposefully inviting and provoking them to reflect, verbalize on, and visualize their (inter)actions and contexts [5, 17]. The technique of probing studies users in their own context by means of probes. Probes come in many shapes and forms varying from experience prototypes [2] to research toolkits that are based on self-documentation and can contain all kinds of artifacts (like a camera, diary, images, postcards) accompanied with evocative tasks [5]. The aim of probing can vary from inspiring design researchers and thus stimulating their imagination [5], to gaining user empathy and access to more versatile, experimental and subjective user data [17], to informing and acquiring insights in future (functional) requirements of a more targeted product [4]. Some probes aim to engage and establish a conversation with users [4, 17]; others observe users or engage with them from a distance to learn about them and about the

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new use and experience of a product or technology (3,12, 14, 22]. Probes can be designed to be (temporarily) part of people's everyday life, be it in their private (family) life [12] or in the public space [22].

In the following, we shortly discuss different existing probes and probing techniques.

3.1 Cultural Probes

The prime example of probes is Cultural Probes (Figure 1) of Gaver et al. (1999) where a multidisciplinary team of artists, design researchers and researchers investigated elderly communities in Peccioli (Italy), Oslo (Norway), and Amsterdam (Netherlands) as part of an EU funded research project. Besides the literature review and the questionnaires the team had conducted, they felt that the statistical facts they found were not sufficient to gain in-depth insight and an empathic understanding of the different communities. Cultural probes i.e. aesthetically well-designed packages (see Figure 1) including tasks such as photographing and answering questions on illustrated postcards, were designed and handed out to the different communities. The probes aimed to avoid addressing user's (functional) needs and desires, which the researchers were already aware of (i.e. the statistical facts). The tasks therefore focused on triggering people's creativity and imagination for example by asking them to answer and elaborate on questions like "If Peccioli were New York...", or to photograph their favorite device, and elaborate on what the particular device meant to them. A few years later, an adaptation to the Cultural Probes was deployed in different home environments, named 'domestic probes' [6].

The general aim of Cultural Probes is to elicit inspirational responses from people, in order to understand their culture, thoughts and values better, and thus stimulate design researchers' imaginations [5].

Figure.1 Cultural Probes package of Gaver et al. (1999), containing evocative tasks, a camera, postcards, etc.

3.2 Experience, informational and empathy probes

The purpose of subsequent versions of different probing techniques started to vary from design inspiration, to acquiring information about users (i.e. user needs, desires), and design empathy.

Buchenau and Fulton-Suri reported on Experience Probes: "...a form of prototyping that enables design team members, users and clients to gain first-hand appreciation of existing or future conditions through active

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engagement with prototypes… By the term Experience Prototype we mean to emphasize the experiential aspect of whatever representations are needed to successfully (re)live or convey an experience with a product, space or system."[2] Through these design representations i.e. the Experience Probes, design researchers mostly probed at users "what it might be like for them to engage with a future product, space or system" they were designing. People receiving the probes were not actively involved in the design process but merely recipients and users of the designed experience. 'Experience Probes' could have different shapes and forms to make up the intended experience. i.e. storyboards, scenarios, sketches, video, simulations.

Crabtree et al. [3] adapted the original concept of Cultural Probes because of the sensitivity of the domestic care context they were interested in. They combined a standard approach of ethnographic inquiries with the concept of Cultural Probes and put emphasis on acquiring insight in potential needs of users through analysis of the data. They created Informational probes [3], probes which were designed to gather subjective information from people and to start a conversation with them [18]. Informational probes differentiate themselves from Cultural Probes by focusing on the informational input for design (as opposed to inspirational). In their paper [3] Crabtree et al. qualify the more traditional ethnographic (i.e. informational) qualities of Informational Probes as more ideal, in comparison to the more designerly and alternative ethnographic (i.e. inspirational) qualities of Cultural Probes [20].

Mattelmäki and Battarbee developed Empathy Probes [17], which are probe packages that are inspired by Cultural Probes of Gaver et al. but combine these with interviews and projective tasks. The aim of Empathy Probes is to go "from rational and practical issues to personal experiences and private contexts" [17] by gaining an empathic understanding through building and sharing design empathy.

3.3 Technology, mobile and urban probes

Technological advancements have made it possible to develop probes with highly flexible, embedded sensing and self-reporting technology. Masten and Plowman already reported 'digital ethnography' as a promising approach with lots of new opportunities to involve users [19]. In the same year, Hutchinson et al.[14] reported on Technology Probes: "simple, flexible, adaptable technologies introduced into families' homes with three interdisciplinary goals: the social science goal of collecting data about the use of the technology in a real-world setting, the engineering goal of field-testing the technology, and the design goal of inspiring users and design researchers to think about new technologies." Technology Probes enabled design researchers and researchers to probe in real-life and remotely gain insight in people's needs, wishes and behavior. Moreover, Technology Probes made it possible to track (and change) people's behavior in context. Design researchers could now, besides following what people did with their designs in context, observe people's (often unconscious) behavior e.g. playfulness, habits etc. and reflect on implications for future design stExperiential Probes .

Urban Probes of Paulos and Jenkins [22] were also designed to probe in context i.e. urban space. They were "a lightweight, provocative, intervention methodology designed to rapidly deconstruct urban situations, reveal new opportunities for technology in urban spaces, and guide future long term research in urban computing." Their aim, similar to other probing techniques, was to better understand people's emotional reaction on the (technological) design concepts they presented to them. Urban Probes were inspirational research into very essence of what new technological concept could mean for people in the urban space i.e. society. Through the probes researchers

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wanted to learn more about their designs in context; if and how people would understand it, learn to use it, talk about it etc.

Mobile Probes arose "from a need to develop contextual and dynamic self-documenting tools for studying people's actions in mobile contexts."[12] They were digital, contextual, interactive probes enriched with all kinds of sensing and tracking technology (i.e. GPRS). Besides that, a system was also developed to send, acquire, log, share and sort the data from the probes. Other functionalities of the system included sending and editing questions, and viewing the answers through a dynamic web server.

4. Designing for societal transformation

In our society we are currently facing a number of complex major challenges e.g., healthy living, the economic recession, safety and attaining a sustainable level of energy and material consumption. Disruptive innovations are needed to create structural and sustainable societal change to face these challenges [8]. Most design processes used today are aimed at incremental innovation and have a problem-solving character. This rational problem-solving process, introduced by Simon [25] can be described as: "the search for a solution through a vast maze of possibilities within the problem space...Successful problem solving involves searching the maze selectively and reducing it to manageable solutions."

In our research we are interested in designing for societal transformation i.e. developing innovative propositions for society to create structural and sustainable societal change to face our societal challenges. For this we however need new processes and tools that are driven by a design vision of how our world could be in the (near) future. The Reflective Transformative Design process [13] describes a flexible, open design process in which a design vision is incorporated and part of the integration of design.

For designing highly intelligent products, systems and services to develop and probe innovative concepts in everyday life with people aimed at behavioral change towards sustainable transformation, Van Gent et al. [8] propose a method called Experiential Design Landscapes (EDL). EDLs are environments, which are part of normal society (e.g., designated area in cities, sports parks etc.) where design researchers/researchers meet real people (not users) and novel systems/products/concepts, called Experiential Probes, can easily be introduced, adapted and tailored towards sustainable societal transformation.

5. Experiential Probes and their qualities

Designing propositions towards societal transformation thus asks for a different approach (i.e. EDL), and different tools and techniques. In the following, we deepen Experiential Probes and their characteristic qualities by using other probing techniques as reference.

5.1 What are Experiential Probes?

Experiential Probes are disruptive concepts of highly interactive and intelligent product-service systems deployed in an EDL [20, 30] (See figure 2.). They are propositions for change allowing and facilitating changing and emerging behavior. By allowing people to use these propositions in their everyday life, design researchers can involve people into the development of new products or systems. By means of the Experiential Probes, the design researchers search and explore design opportunities together with the people in the EDL. This way the design

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researchers gain insight and understanding in the (latent) needs, behavior and experiences of the people using the Experiential Probes, allowing them to further develop and tailor the proposed concepts towards new, changing or emergent behavior.

Experiential Probes act as smart sensor agents and can be seen as probes as they use their intelligence (i.e. smart sensing, behavior recognition and data mining algorithms) to gather data on their use and on the (behavior of) people in the EDL. Through adaptive questionnairing and sensoring [28] people provide feedback without being obtruded (too much) in their natural use of the Experiential Probes. Experiential Probes enable detailed analysis of the emerging data and behavior patterns as a source of inspiration for the design of future products, systems and services. Through the smart sensing, behavior recognition algorithms and data mining techniques design researchers can analyse possible new behavioral and usage patterns that may emerge as a consequence of a variety of design interventions.
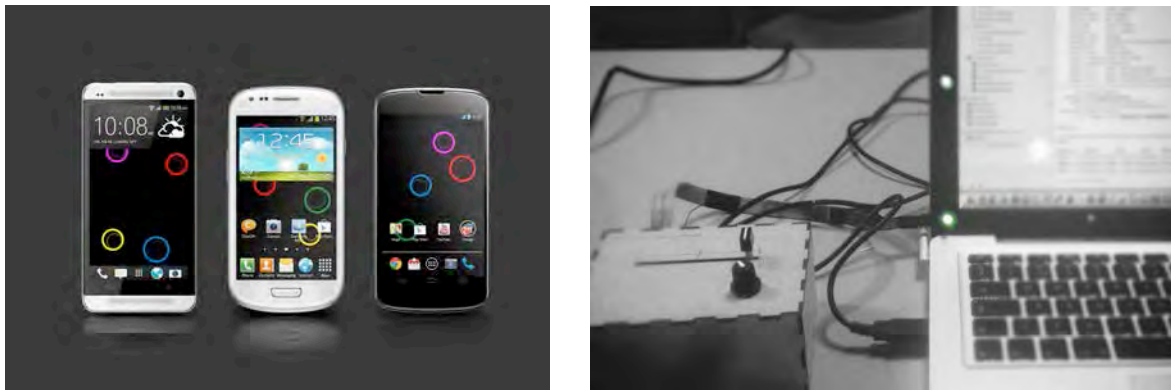

Figure.2 Two examples of Experiential Probes. Left image: Bouncers [21], visualizes physical activity using the accelerometer data of an Android smartphone. An individual's activity is represented in the speed of one circle in the wallpaper. Other circles represent the physical activity of a selection of your friends. The information about one's physical activity is therefore shared in a small and close group of friends. This Experiential Probe explored the topic of social wellbeing amongst friends. Right image: Face-it, a screen border with LEDs placed on a laptop screen. Attached is a control unit with which different modalities of interaction could be explored. This Experiential Probe explored the topic of how people keep concentration or get distracted.

5.2 Informational and inspirational data

Experiential Probes can both inform and inspire the different stakeholders in an EDL i.e. design researchers of the Experiential Probes, the people using the Experiential Probes, passers-by etc. Informational data of the Experiential Probes, acquired through the smart sensing, behavior recognition and data mining algorithms, can offer sound factual data to validate or ground design decisions. Inspirational data, acquired through the Experiential Probes or through the interaction with the people using them, can stimulate imagination and the emergence of new ideas. Aim of Experiential Probes is to allow and facilitate new, changing and emergent behavior [21]. The dual nature of Experiential Probes, being inspirational and informational simultaneously, offers inspirational freedom comparable to e.g., Cultural Probes of Gaver et al. [5], but also validity of the method (and the data), like with Informational Probes [4, 9].

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5.3 Observe, interview, explore, trigger, disrupt

Through Experiential Probes design researchers can do multiple design actions. Experiential Probes can enable design researchers to actively observe people (in-situ as well as from a distance), as well as return data real-time through interacting with the Experiential Probes. This way, design researchers can gain immediate insight in people's (emergent) behavior and possibly providing inspiration for new ideas.

Through observing, interviewing and questioning, design researchers can find and address specific examples of behavior and learn more about why people express particular behavior. Herewith design researchers attempt to deepen their understanding and obtain a first person perspective on the occurrences and behavior in the EDL [21].

Tracking data from people and observing their behavior from a distance are also qualities probing techniques like Technology Probes [14] and Mobile Probes [12] posses. The same applies for engaging with the people you probe, or initiating a conversation with them (like with Empathy Probes[17], Experience Probes[2], and Informational Probes[3] etc.) However, with Experiential Probes design researchers also actively explore and validate in context through design, with the people using the Experiential Probes. Doing so, the design researchers acquire sensitivity how to design towards the intended behavior change. The design researchers have to both trigger and understand new and changing behavior. The possible emerging behavior is reflected to the design researchers' vision on how to make society more active and healthy, and may spark new ways to create a structural and sustainable future behavior change through a highly iterative process [21].

5.4 Probing for changing behavior and emerging behavior patterns

One of the key qualities of Experiential Probes is that they can probe dynamic situations i.e. changing or emerging situations. Experiential Probes are propositions for change allowing and facilitating new, changing and emergent behavior (i.e. transformation). Moreover, Experiential Probes themselves are highly dynamic as well; they can be easily redesigned, altered or tailored. One the one side, design researchers are able to design the Experiential Probe (together with the people), and observe/analyse what happens to it, engage with the people using the Experiential Probe etc. On the other side, design researchers have the ability to (re)design, alter or tailor the e with the aim to understand possible changing or emerging behavior of people.

This particular dynamic quality is also what Experiential Probes differentiates from existing probing techniques. Technology Probes[14], Mobile Probes[12] and Urban Probes [22] also touch upon aspects of probing in the real world and capturing real-time sound data (e.g., individual, social, environmental) that can feed/support the design process. The difference with Experiential Probes is that the latter probing techniques often probe with an already finished product or solution offering; they don't probe changing or emergent behavior. Experiential Probes are not the intended finished product; they are design propositions used as a research vehicle to learn more about people and their changing or emerging behavior, choices, values, thoughts, life, culture, etc. In the end, the final design of the product-system can be/look completely different than how the initial Experiential Probes were designed.

6. Discussion; merging analysis and design synthesis

In the beginning of this paper, we discussed the relation between probes and design research. We stressed the inherent interest of design researchers to learn about the design context and the people in this design context. For this purpose, already several probing techniques have been designed and deployed, each of them excelling in

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different qualities i.e. acquiring inspirational/informational data, probing user experience/acceptance, gaining design empathy, initiating/facilitating user dialog and participation etc. We introduced our research interest in designing towards societal transformation and the need for a different approach to design, the design process, and accompanying (probing) methods and tools. We introduced Experiential Probes and elaborated on their qualities.

When we look at the different existing probing techniques, in relation to Experiential Probes, the majority of (traditional) probes seems to make a deliberate split between analysis and design synthesis; the design researchers design the probe, deploy it in the field and observe or reflect on its effect on the design context, the people etc. Some probing techniques already open a dialog with users in the design context through interviews and active participation by making them users design partners. For designing for sustainable societal transformation it is important to facilitate exchange between design researchers and people in the design context through designing in short loops of analysis and design synthesis, with dynamic propositions with an open meaning, *with* people instead of *for* people, in a joint desired direction towards societal transformation. Experiential Probes actually disrupt the current situation and position the design researchers in the middle of the disruption together with the people using the probe in their everyday life. The design researchers search and explore opportunities together with the people using the Experiential Probes in short loops of analysis and design synthesis. This way of probing allows the design researchers to gain a first person perspective and understanding of the people in the EDL.

Technology is becoming more advanced as well. The size and amount of computing power we carry with us is increasing everyday. More and more products and systems are becoming intelligent, networked and designed to be part of our everyday life and society. Through our smartphones we carry a wealth of sensors (e.g., acceleration, GPS) in our pockets and these are usually 'always ON'. In addition, our homes as well as public spaces are increasingly being enriched with embedded contextual sensors, including motion detectors, cameras, etc. The widespread deployment of these technologies have created an unprecedented ability to track people and record behaviors and contextual variables in real-time, over extended periods of time, and within the living and working environments people inhabit in their everyday life. Design research and experimentation can start to take place anywhere and anytime in the real world, inevitably entailing both consequences and opportunities for the nature of the design process, and accompanying methods and tools. For instance, much attention will need to be devoted to the legal and ethical boundary conditions of recording, analysing, and utilising such personal and contextual data in the design process.

Masten and Plowman already discussed such a new ethnographic approach full of opportunities: 'digital ethnography' [19]. They foresaw design ethnographic tools being updated with the latest novel technologies e.g., digital cameras, mobile phones, computer and server systems etc. enabling remote and simultaneous user observation, automatized data sorting and mining, and the creation of user databases. Furthermore, users could also "become more active contributors instead of being only passive sources of data."[19]. Through the EDL method, we are currently taking some of the first steps in this direction by probing with these novel technologies in this new field of opportunities together with people as active contributors, in a highly dynamic and changing design context, jointly aimed at achieving next steps towards sustainable societal transformation.

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