Abstract
Theoretical frameworks are often applied and created in the HCI healthcare fieldwork domain, but for less contained non-clinical settings such as medical devices used on the go, there has been little exploration of theories involving user experience. In this paper, I will introduce a project that is focusing on the situated use of mobile medical technologies by people with Type 1 diabetes and the user experience theories that are framing this work. Using user experience frameworks that have developed from the third-wave HCI shift from focusing on technologies used in the workplace to technologies used in everyday life, I present how they might be connected to the evaluation of medical technologies used by laypeople for the self-management of their own health and safety.

Author Keywords
Healthcare; user experience; diabetes; mobile; theory.

Using A Third-Wave HCI Approach for Researching Mobile Medical Devices

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Introduction
There is a worldwide trend to move patients out of clinical settings in order for them to self-manage health conditions at home with medical technology [6]. This move is meant to reduce the cost of hospitalizations as well as improve quality of life by allowing patients to live more independently, but issues arise with taking medical devices outside professional institutions. Some devices must be used on a more regular basis and have to be used by laypeople such as caregivers and patients. These medical devices can be used in people’s homes, but some devices must be with the patient throughout the day, which means that the devices have to be mobile and they will not be used in static contexts.

My research is on one such group of mobile medical technologies: those used for the self-management of Type 1 diabetes. Type 1 diabetes is a chronic condition that requires a lifetime of everyday self-management [7], and the technologies to aid these practices can be used anywhere, anytime, and with anyone. As such, the user experience of the device is an important consideration, and has shown to influence adoption and use of these medical devices in my preliminary results [8]. User experience theories have been used to plan the studies, choose the data collection methods, and conduct the studies with users...
of Type 1 diabetes technologies, and they will also be used to frame the analysis.

**Everyday Type 1 Diabetes Technologies**

In order to manage blood sugar levels, people with Type 1 diabetes use a variety of tools and technologies and because of the complex nature of the condition, people’s adoption and use of diabetes technologies differ significantly. The technologies focused on in this research include glucose meters, continuous glucose meters, insulin pumps, and mobile phone applications.

Glucose meters are used to measure blood glucose levels. These measurements are used for everyday calculations of medication doses as well as identifying hypos and hypers [10]. The meter is used in conjunction with a finger-pricking device or lancet that is usually used on the tip of a finger. The small droplet of blood is put on a testing strip that is used by the meter to test blood glucose levels.

Although people with Type 1 diabetes use glucose meters manually several times per day, there are technologies that allow more consistent monitoring but they are not that commonly used. Continuous glucose meters are used to give blood glucose readings every few minutes [4]. A sensor is attached to a person’s torso with a small needle inserted to test the level, which is communicated through a small wearable transmitter to a receiving device.

Insulin pumps can come in a few different form factors, including attached to the back of a user’s arm or in a pager-sized device that is attached to a tube on the abdomen of a user. They require power from batteries, liquid medication from vials added to the device by the user, and also for the user to use it like a remote to control the injection of medication through the tube. When the are used properly, they can help control blood glucose levels better [11].

In order to maintain their condition, people with diabetes can turn to personal informatics sources, including tracking their own health data and getting suggestions for insulin doses using applications (apps) that they have downloaded on their mobile phones. There are many apps currently on the market: a quick query of smartphone application stores for diabetes related applications results in a large search result (over 1500 in the Android Play store at the time of writing).

Although people with Type 1 diabetes can choose to use a variety of these mobile technologies, the majority have used at the least one for many years: a glucose meter. As such, they are an ideal set of users to explore the influence of user experience on the use of mobile medical technologies through third-wave HCI approaches.

**Third-Wave HCI Approach**

There has been a shift in HCI to address the move from technologies used in the workplace to ones that pervade everyday life. Third-wave HCI seeks to address issues of emotion, needs, values, etc, in the design of interactive technologies [2]. The problem is, modern medical devices that resemble third-wave technologies challenge traditional definitions of usability, and distort the boundary between medical devices and consumer technologies. Some of these technologies are mobile, and as such, are used in many different environments in ways that are hard to predict.
Suchman first presented the idea that plans do not always represent the actual performance of tasks in the situation [9]. Through looking at the use of a photocopier machine, she was able to observe that the task breakdowns in plans did not represent the actions those using the technology actually did in the situation. Plans are inherently connected to the situations in which they are used, and therefore are context-dependent. This flew in the face of traditional HCI researchers who did not take sufficient account of the 'situatedness' of actions, relying on traditional accounts of cognition as internal and independent of context in interaction design. Her work has been highly influential in HCI, and particularly for those looking at the influence affect can have in interaction design.

Affective experience is hard to define and attempts may seem reductionist, with Boehner, Sengers and Warner claiming that for the related concept of an aesthetic experience, “most maintain that it cannot be fully understood through rational explanation but must be lived” [3]. These researchers fall into the interactional approach to affect [3]. They suggest the traditions of HCI are rationalistic, and many might approach defining aesthetic experience by formal and HCI legitimate methods. Although HCI values formal models, taxonomies, and context-independent methodologies, limitations to these methods are quite significant as they are all reductionist in nature. Opposed to delimiting emotions, they claim that emotions are culturally informed and experienced dynamically, influenced by action and interaction.

Like the interaction as affect perspective, McCarthy and Wright’s Technology as Experience approach does not attempt to reduce emotion to definable components and focuses on the entirety of the experience with technology [5]. It goes beyond the interactional approach in that it does not treat emotion separately, but rather as a part of a holistic ‘experience’. The authors suggest a move from a deterministic view of design to acknowledging users’ agency: not designing an experience but designing for experience. The authors argue against taking the richness of experience and trying to reduce it to “design implications, methods, or features” [5], although this leaves designers with a fuzzy concept to work with. McCarthy and Wright take examples from art and literature as inspiration about the way we should deal with interactive systems: it is not just the design of the system, but rather the entire experience of interacting with the technology in context which is of importance.

**Third-Wave Mobile Medical Device Research**

The third-wave approach shifts HCI from a focus on strict usability towards looking at user experience. HCI has progressed from seeing a user as a cog in the system to a source of error to a social actor, and now users are seen as consumers. As such, user experience is an important concern for the adoption and use of third-wave technologies, even those used in safety critical domains such as healthcare.

Affective experience should be a consideration for something that might elicit strong and complex emotions, such as using a mobile medical device on your personal being when your health or welfare is at stake. By making assumptions for a certain population, emotion, context, etc., the device might be designed inappropriately. As such, my work on mobile medical technology has used these third-wave influences to frame my research approach.
Although the medical usability standards [1] do note the importance of context, the methods recommended by the standards do not fully accommodate the range of emotions and experiences that could accompany the personal use of mobile medical devices in context by patients. As such, I am exploring the use of methods used in the user experience domain, such as autoethnography, contextual interviews, diary study, and contextual focus groups.

Additionally, how the studies were conducted was influenced by the focus on affective experience. I started this body of work with a self-study in order to gain empathy for some of the experiences that mobile medical device users go through [8]. This also influenced how the diary study was planned as it allowed me to experience what it is like to have to add another step when using a medical device in order to collect data. The interviews were conducted with a focus on the user experience and context of use of the device, with questions that explored people’s past experiences with the devices. The interviews were conducted in a semi-structured manner in order to allow more open comfortable conversations about past affective experiences.

I intend to use the Technology as Experience approach to not delimit emotions and experience when examining the use of these devices. By first focusing on the adoption/non-adoption and use/misuse and then looking at the greater context in which these actions happened, I hope to explore the influence that affective experience has on this user behaviour.

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**References**


