Challenges and Opportunities in Designing Technology to Support "Do-it-yourself" Experimentation

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Abstract

In this workshop, we will discuss challenges and opportunities associated with self-experimentation of the kind that is typically conducted with "DIY" health technology. Self-experimentation for health is becoming more common as consumer self-monitoring technology improves, but there are many related challenges that must be addressed in order to reliably obtain insight into one's health through this process. In this paper, we focus on challenges distilled from a preliminary literature review of self-experimentation in health, including forming hypotheses, testing data, and understanding true scientific experimentation, and we look to assess opportunities for improving self-experimentation in DIY settings.

Author Keywords

Self-experimentation; health technology; DIY; experimental design.

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction

Self-experimentation is experimentation on oneself [8]. It has a long history in the healthcare field, with discovery of blood types, cardiac catheterization, and many more med-

ical advancements all involving the researchers as participants [4]. Historically, much self-experimentation was done in medicine and psychology [8], often by clinicians and researchers themselves. With the influx of personal data that can be collected today, however, more lay individuals are able to conduct self-experiments with a goal of improving their own health and well-being.

As self-monitoring grows in popularity, people have more ways to customize existing technology and even prototype new hardware and software. The DIY movement has—in part—arisen from this availability and motivation, as more lay people begin using conventional materials for new and unconventional purposes and augmenting existing commercial and health tools for improved personalized tracking, as in the Nightscout diabetes project [7]. Especially for people with chronic illnesses like diabetes, there are "mundane lifestyle demands" that may not be considered by clinicians or existing technology [9]; DIY tech allows for improved flexibility and control in one's health and its impact on daily life.

At the workshop, we will present insights culled from a preliminary literature review examining how self-experimentation has been treated in:

- the medical literature,
- the HCI literature,
- and relevant online blogs and forums.

Through a preliminary reading of these sources, we have distilled challenges and opportunities for "do-it-yourself experimentation" that we hope to bring to light and refine through discussion at the workshop. By conducting and sharing this preliminary review, we hope to work with other workshop participants to arrive at evaluative approaches, identify avenues for further research, and understand important implications for systems enabling self-experimentation for the DIY movement.

"Do-it-yourself" Experimentation
With DIY technology comes the need for "do it yourself" experimentation. While those interested in conducting health-related self-experiments, through manual tracking or the use of commercial tools, are becoming more able to find instructions and discussion in the literature and online forums [1] [5] [10], there is little conversation around the added complexity of self-experimentation using DIY technology.

To "DIY" personal health technology, and in some cases disseminate the result, an individual plays many roles: as designer, architect, developer, tester, user, etc. With the same layperson filling all of these roles, inexperience, biases, and a lack of oversight can pose considerable challenges. Health adds another important layer of complexity to this DIY process, as experimental design and decision-making play such a key role in evaluation, and challenging scenarios in a personal health context can even mean danger for a user.

However, DIY experimentation also offers incredible opportunities for improved personal health and general well-being. Users and their tools are not limited by the same regulations, personal involvement and motivation are high, and there are enthusiastic and growing communities of people eager to be involved and to enhance their technologies and their health [7] [10].

Self-experimentation in the Literature
Medical:
Documented self-experimentation in medicine is less common than it used to be [12]. In both the medical and computing fields, however, crowd-sourced research - especially for health - can now be leveraged for experimen-

tation in a way that has never been possible before [11]. As the health field moves towards the personalization of healthcare in many instances, "n-of-1" experiments are also gaining ground. While more formal than non-expert self-experimentation, these "single subject clinical trials" may be able to guide self-experimentation to a place of improved scientific rigor [6]. However, connecting self-experimenting individuals to larger bodies of evidence and trials is an on-going challenge.

HCI:
In the HCI community, guides for improving, easing, and automating self-experimentation have also been proposed in the form of toolkits [3]. Additionally, an understanding that one size does not fit all has led many researchers to design in a way that allows for personal experimentation [9] and appropriation of technology [2]. In doing so, they aim to anticipate the unexpected and allow for more flexible use and experimentation. A challenge that remains is leveraging these strategies in a way that can improve the scientific rigor of non-expert self-experimentation, and perhaps focusing on the vulnerable populations who could be most helped by personal health experimentation.

Other:
Outside of the academic literature, there are many blogs and forums dedicated to self-experimentation for improved health and behavior. These writings are often found within the Quantified Self community, as many past and current self-experimenters are eager to share instructions and feedback on how others can improve their own well-being with similar experimental tactics [1]. However, in our preliminary review we have found that much of the focus in online self-experimentation literature is solely on operationalizing variables and designing experiments [1]; these are crucial processes, but they are not the whole story, as

forming hypotheses (an important place to start) and testing your findings (an important final step) are often left out. In addition, there seems to be confusion about what self-experimentation really means and how to best utilize experimental tactics to improve health.

Conclusion
At the workshop, we will discuss our review of the medical, HCI, and online literature and share our insights into the components of successful self-experimentation and how current challenges and successes can be utilized in self-experimentation by DIY makers and technologists. We will also explore some of the overlooked benefits technology could bring to self-experimentation, such as assistance with randomization, experimental design recommendations based on the volume and type of data collected, or collection of additional contextual factors. As self-monitoring and DIY technology add a new dimension to personal health tracking, understanding how to best design, conduct, and test personal experiments will be key to leveraging the opportunities for advancement that self-experimentation brings.

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