Distinguished Dissertations

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Designing for empowerment – An investigation and critical reflection

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Abstract: Technology bears the potential to empower people – to help them tackle challenges they would otherwise give up on or not even try, to make experiences possible that they did not have access to before. One type of such technologies – the application area of the thesis presented here – is health and wellbeing technology (HWT), such as digital health records, physical activity trackers, or digital fitness coach applications. Researchers and companies alike often claim that HWTs empower people to live healthier and happier lives. However, there is reason to challenge and critically reflect on these claims and underlying assumptions as more and more researchers are finding that technologies described as empowering turn out to be "disempowering". This critical reflection is the starting point of the thesis presented here: Can HWTs really empower people in their everyday lives? If so, how can we design for empowerment?

In my cumulative dissertation, I combine studies on existing HWTs, such as patient-controlled electronic health records and personalized mobile fitness coaches with the development of novel prototypes such as transparent digital fitness coaches that communicate their rationale to the user. By reflecting on these case studies, I come to revisit the sometimes washed-out meaning of "empowerment" in "empowering technologies"; I introduce a framework to establish conceptual clarity; and I suggest three principles to design for empowerment based on my own work and the Capability Approach by Sen and Nussbaum that aim to inform and inspire research on HWTs and beyond.

Keywords: Empowerment, health and wellbeing technology, human-computer interaction

ACM CCS: Human-centered computing → Human computer interaction (HCI) → HCI theory, concepts and models

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1 Introduction

The vision to *empower* people with technology has appeared in numerous HCI keynotes [24, 37] and articles [8, 27, 20]. Beyond the HCI community it has been discussed in disciplines such as computer ethics [17] and medicine [31] and appeared in many technology companies' mission statements: Microsoft, for example states "Our mission is to *empower* every person and every organization on the planet to achieve more."[26], while the mission of Fitbit is to "To *empower* and inspire you to live a healthier, more active life"[10].

In the application area of this thesis – health and wellbeing – it is often assumed that HTWs *empower* people based on the following rationale: The state of our physical and mental health determines our abilities – our "power". Consequently, health problems, such as diabetes, dementia, or depression can be a very disempowering experience. Researchers in both medical and computer science hence hope that technology can help people to prevent or overcome this disempowerment, in other words to better care for their physical and mental health. The number of different technologies designed for this purpose is rapidly increasing. It ranges from sensors that track body signals such as respiration, physical activity, nutrition, and sleep to health records or platforms that keep track of a person's illness trajectory and provide behavioral recommendations. However, several authors have raised concerns that technologies that are described as empowering, can end up ultimately *disempowering* people [21, 40]. These doubts are closely related to HTWs being associated with feeling stigmatized [27], patronized [11, 21] and expected to manage complex conditions oneself [33]. Moreover, HTWs made people more pessimistic about their health condition [25], increased feelings of anxiety, failure or self-hatred [22], and even increased symptoms [6, 39].

In my thesis, I investigated different approaches to designing HWTs and how they empower their users. In section 2, I give an overview of my case studies and explain how they led me to revisit my understanding of empowerment. To understand what counts towards empowerment in the HCI literature, my colleagues and I con-

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ducted a structured literature survey and created a four-dimensional framework of empowering technologies, introduced in section 3. Finally, in section 4, I build on my own work (section 2), the framework (section 3), and the Capability Approach (CA) by Sen [38] and Nussbaum [28] and suggest three principles for designing empowering technologies.

2 Case studies on empowering HWTs

Below, I subsume my case studies in the domain of HWTs in three interaction paradigms because they serve as clear and strong metaphors and catch properties of technology that I believe are vital for their empowering and disempowering qualities: *computer-as-tool* and *computer-as-partner* as described by Beaudouin-Lafon [2], and *computer-as-intelligent-tool* (added by me).

2.1 Computer-as-tool

In Beaudouin-Lafon's words, technology in this paradigm "extends human capabilities through a (very sophisticated) tool, just as the invention of the wheel allowed us to transport heavy loads over long distances" [2]. HWTs in this paradigm typically provide data tracking and analysis features that allow users to investigate their own health data.

In my research I investigated, for example, the use and non-use of patient-controlled electronic health records (PCEHR) [33] – a technology often assumed to empower patients to take control of their own health [31]. In observations and interviews with 16 patient families, I found that PCEHRs empower only those with a very proactive, so-called approach-oriented coping style. Other users were overwhelmed by the data presented or intimidated by the perceived obligation to engage with them. I, hence, concluded that even though PCEHRs foster patients' awareness and knowledge about their health condition, they often do not feel empowered. This finding resonates with other work concluding that healthcare technologies often mirror system not individual goals [40]. As a way to meet users' individual needs, I explored personalization mechanisms in the second group of case studies.

2.2 Computer-as-partner

To cite again Beaudouin-Lafon, this paradigm "embodies anthropomorphic means of communication in the computer, such as natural language, so that users can delegate tasks" [2]. HWTs in this paradigm include personalized health and wellbeing coaches that adapt to users' individual characteristics and goals by tailoring, for example, recommendations, communication style, or motivational strategies to suspected needs of the user.

Over the last years, researchers have presented multiple systems that combine behavior tracking with recommendation algorithms and as a result suggest beneficial food and physical activity choices optimized to the user's daily routine [3, 30]. In my work, I contributed to this line of work by investigating how the motivational strategies [34] and the communication styles [35] of digital health and wellbeing coaches can be adapted to the individual user, both yielding promising results. For example, in a study using Personal Value Theory and the Theory of Planned Behavior, my co-authors and I found that users' value structure has significant influence on their motivation to work out with a digital fitness coach [34]. The correlation between users' behavior and their motivational structure can, in turn, be used to make digital fitness coaches more persuasive and effective, e. g. by crafting more convincing arguments.

On one hand such technologies might empower a wider range of users to implement a healthy lifestyle and to ultimately achieve greater wellbeing (assuming that provided recommendations will help to lead them there). On the other hand, intelligent personalized systems seem to go against users' sense of agency as users tend to overtrust and naively rely on them [7, 15] (and I will elaborate on my reasons to consider a sense of agency vital for empowerment in section 4). Hence, I turned to exploring ways to prevent overtrust and foster users' sense of agency by allowing them to scrutinize the systems' functioning in the *computer-as-intelligent-tool* paradigm.

2.3 Computer-as-intelligent-tool

I added this paradigm to combine the advantages of the other two, namely the technical possibilities of *computer-as-partner* with the ultimate power of decision that users possess in *computer-as-tool*. In this paradigm, computational possibilities are leveraged to help people best achieve their goals. However, at the same time we strive to maintain system transparency, foster users' awareness and embrace their decision power. HWT that follow this paradigm are intelligent personal coaching systems that disclose their functioning on demand to render it as a tool.

The importance of transparency in intelligent systems has long been discussed in academia. Making an intel-

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ligent system and its underlying design decisions transparent, i. e., explaining how the system works, has been shown to improve users' mental models of that system [18, 19]. Improved mental models, in turn, contribute positively to user satisfaction and perceived control [19] as well as to overall trust in the system [23] and its decisions and recommendations [5, 32].

In my own work, I wanted to understand how introducing transparency in HWTs can help users to develop appropriate levels of trust and increase their sense of agency and control. However, transparency in intelligent systems is currently not common in industry and prior work does not offer guidance on how to integrate transparency in an existing system [9]. Hence, my colleagues and I explored ways to do so in a six-months project with the company Freeletics, which provides personalized digital fitness coaches. In this complex real-world design scenario, we developed several concepts to help users understand which information is used by the "coaching intelligence" to calculate their workouts. The evaluation was positive: users mental model improved after interacting with the prototype. As many designers of intelligent user interfaces might face similar challenges when integrating transparency, we extracted our learnings in a stage-based participatory process for designing transparent interfaces incorporating perspectives of users, designers, and providers [9]. Our concepts and process are explained in detail in the publication [9] and the supplemental material.

Reflecting on the above described case studies, I tried to get to the bottom of what makes HWTs empowering. In the final stage of my thesis, I therefore (1) analyzed how other HCI researchers have used the term and (2) formulated three principles for empowering technologies drawing on the CA by Sen and Nussbaum and my own research. The former resulted in a four-dimensional framework presented in section 3; the latter are presented in section 4.

3 Conceptual clarity

To understand what researchers who describe technology as empowering or disempowering refer to, my colleagues and I conducted a structured literature survey of HCI work using the term "empowerment". To complement our findings, we consulted work in social and political sciences (for details on our methodology please refer to [36]). The result was: Researchers' concepts of empowerment differ widely. In fact, they differ in (at least) four dimensions, which we subsumed in a framework of empowering technologies. In brief:

First, researchers' concept of power differs: Some refer to power as a means to get other people to do what they want while others see it as an ability to do something. These two different concepts have been labeled *power-over* and *power-to* [1]. People with an understanding of *power-over* would refer to a system that helps a community to confront policy makers as empowering as it helps users to regain power that other people have *over* them. In contrast, people with an understanding of *power-to* might find their smartphone is an incredibly empowering technology because it allows them to do so many things they would otherwise not be able to (talk to their aunt in Canada, find the next petrol station and the best route to get there, look up the stock prices, to name some examples).

Second, the outcome of empowerment can be on different levels: Are you empowered if you *feel* powerful, if you *know* more, or if you are able to *do* things you otherwise could not? This distinction was adopted from the theory of psychological empowerment by Zimmerman [41]. We included it in our framework because the three components can contradict each other, so being clear about one's focus helps to prioritize: For example, a digital health record that tells you everything about your genetic predispositions increases your self-knowledge but at the same time you might feel horrible or helpless. Or, think of a system that uses hidden balancing to allow people with disabilities to compete with able-bodied peers – it helps them to feel more powerful but for the cost of truthful feedback (see [13]).

A third difference between systems is that some empower users primarily during system use, for example, a prosthesis, while others empower beyond system use, for example, an educational system that helps you to build a new career. Accordingly, we distinguish between *persistent* and *transient* empowerment (again based on work by Zimmerman [41]). Clearly defining the intended persistence of empowerment can help to address concerns about software systems "eroding skills, diminishing contextual and critical thinking, and creating a culture of distraction and dependency" as put by the author and CHI'17 keynote speaker Nicholas Carr [4]: For example, while a navigation system allows us to effortlessly navigate previously unseen territory (short-term, or *transient* empowerment) – it also leads us to depend entirely on it, so that we are (following Carr's argumentation) today much worse in navigating without technology than our grandparents were. To address this, system designers might ask how they can design systems that improve people's ability to

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navigate without technology (if this is considered an important skill).

Finally, researchers differ in their approach to developing empowering technologies. Often, we identify a need for empowerment from a third person perspective: For example, US-based scientists expected that children in developing countries would benefit highly from owning a laptop for educational purposes and founded the initiative "One Laptop Per Child".[1] This need for a laptop was not expressed by the children themselves. In contrast, other researchers stress that "power can not be given, only taken"[16]. Following this argument, empowering technology has to be designed from the perspective of the ones that shall be empowered. However, both perspectives have their justifications.

As demonstrated by the above described dimensions, research in HCI has not agreed on a common understanding of empowering technologies. In the next section, I therefore propose three principles that might serve as a minimal conceptual basis – building on my own work and the Capability Approach (CA) by Sen [38] and Nussbaum [28].

4 Principles of empowering technology

The CA has been pioneered and developed by Nobel-prize-winning economist Amartya Sen and philosopher Martha Nussbaum [28, 38] and has become influential, e. g., in welfare economics, international development and human rights. Recently, several authors in computer ethics, philosophy and Information and Communication Technology for Development (ICT4D) have suggested the CA as a useful lens to analyze ethical implications of technology, and specifically to what extent they empower people (e. g. Johnstone [17], Oosterlaken [29]). In my work, I follow their argument and their calls to develop practical design guidelines and tools that operationalize the CA for technology design.

In brief, the CA states that the freedom to achieve well-being is of primary moral importance and can be understood in terms of people's capabilities, that is, their realistic opportunities to do and be what they have reason to value. Understood in this way, an increase in capabilities is equivalent to empowerment. Capabilities represent the power of the individual (or group) to avoid harms, pursue valued forms of living, and to make reasoned determinations of what is to be valued [17]. In other words, they represent the choices the individual has – but note that not all choices are relevant but only those "among valued alternatives" [17]. The ethical maxim of the CA implies that a just society is one in which the opportunity to develop and express capabilities is provided to all. Below, I draw on the CA to outline three principles, which I feel can add a valuable perspective to the discussion on empowerment in HWTs. By doing so, I try to balance inherent philosophical intricacies of the CA with the need for practical and actionable advice for technology design (as discussed in [29, 17]).

4.1 Offer choices

According to the CA, the freedom to make choices is a value in itself. Johnstone emphasizes this when stating that capabilities or empowerment include "both the capacity to make rational determinations of value and to realise them" [17]. This is interesting, when we think of algorithms that to make recommendations and decisions for us. For example, a social media feed presenting personalized content without adequate control mechanisms provides only one choice to users: to use it or not to use it. Similarly, a food recommender, a digital fitness coach and a navigation system do not foster a sense of agency but deliver the impression that the recommended choice is the optimum. It is easy to imagine a future in which users come to rely more and more on the output of such algorithms, critical thinking diminishes (as described by Carr [4]) and power converges in the hands of technology developers (as described by Harrari [14]). An approach to developing technology based on the CA reminds us of the importance of fostering choice and upholding users' agency. Of the technologies in my case studies this principle is well reflected in the paradigms *computer-as-tool* and *computer-as-intelligent-tool* but less so in *computer-as-partner*.

4.2 Offer valued alternatives

However, offering choice alone is not enough if it does not reflect users' needs, goals, and values – as the CA decisively emphasizes. This might seem trivial, because it is well-reflected in the traditions of user-centered design (UCD) and participatory design (PD). However, I think it is worth being pointed out, because (1) it might provide a

1 http://one.laptop.org/

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currently missing philosophical foundation to these traditions and (2) it is less self-evident than it might seem:

(1) In UCD and PD, user participation is often seen as a method – an instrument to reach pre-set goals such as technology adoption. Here, the CA can contribute a philosophical foundation [12, 29]. This means that based on the CA practitioners can define and challenge project goals from an ethical perspective and underpin their design decisions with ethical arguments.

(2) In my research, I found that HWTs do not necessarily meet users' needs, goals and values [33]. Similarly, others have criticized that these technologies encapsulate external goals (e. g., think of technologies encouraging people to "adhere" to medication or other therapy regimes) [21, 40]; these goals are oriented to optimal health achievement as opposed to the realistic aims and values of people motivated by broader wellbeing needs. Hence, they do not meet people "where they are".

Outside of the domain of health and wellbeing, researchers and practitioners have raised broader concerns about the value-alignment of technologies and their users: For example, Harry Brignull coined the term *dark patterns* to spread awareness of "tricks used in websites and apps that make you buy or sign up for things that you didn't mean to".[2] On a similar note, Tristan Harris, formally ethicist at Google, founded the "time well spent" movement.[3] Its aim is to spread awareness of "screens [that] threaten our fundamental agency. Maybe we are 'choosing' but we are choosing from persuasive menus driven by companies who have different goals than ours".[4] Hence, it might be about time to (re)articulate the principle to design for peoples' needs, goals and values.

4.3 Acknowledge both experts' and users' perspectives

Considering the debate between a participatory and an expert design mindset (the fourth dimension described in section 3), the CA offers an interesting perspective as well. On the one hand, participatory methods are to be preferred from a moral perspective – out of respect for people's agency [29]. On the other hand, if disadvantaged people have come to accept their personal circumstances, we can according to Sen [38] not conclude that there is no injustice in their situation due what he calls the phenomenon of *adaptive preferences*:

> *"Our desires and pleasure-taking abilities adjust to circumstances; especially to make life bearable in adverse situations. [...] The deprived people tend to come to terms with their deprivation because of the sheer necessity of survival; and they may, as a result, lack the courage to demand any radical change, and may even adjust their desires and expectations to what they unambitiously see as feasible."*

To still apply participatory methods in a situation with adaptive preferences, Oosterlaken [29] suggests to explicitly address people's capabilities to participate in the design of technologies themselves. Such capabilities may include "information, knowledge, evaluation, participation, and authority" [29].

4.4 Consider diversity of contexts and humans

According to Sen and Nussbaum, new opportunities are only empowering when they can be realized. For example, a bike has the *characteristic* of transportation but only for an able-bodied person using it. The factors that have to be in place for a person to realize the capability (in this case moving from one place to another) are called *conversion factors*.

This concept renders digital technology a particular versatile tool for empowerment, because it can dynamically adapt to different users and context: Developing effective adaptation algorithms has been a topic for research for over 30 years and is accelerating thanks to newly developed machine learning algorithms. If the capability that technology shall support is well defined and conversion factors are well understood, we can develop algorithms that adapt the technology dynamically to provide the capability to a wider range of users in a wider range of contexts/environments.

4.5 Summary and conclusion

I started my dissertation (and this article) by noticing the widely assumed and advertised potential of HWTs to empower people. However, at the same time, newly published research increasingly reported negative effects of HWTs of people's quality of life. I, hence, conducted a series of case studies to understand when and how HWTs can empower people, which I subsume under the paradigms *computer-as-tool*, *computer-as-partner*, and *computer-as-intelligent-tool*. I then revisited the notion of empowerment (as a result of a reflection on these case studies) and conducted a structured literature review on HCI research using the

2 https://darkpatterns.org

3 http://humanetech.com

4 http://www.tristanharris.com/essays/

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term empowerment – together with my colleagues. The result was a four-dimensional framework (and a classification of HCI research in different lines of empowerment research in the corresponding paper). Based on these findings, I identify the need to base research on empowering technologies on a firm philosophical foundation and I suggest to take inspiration of the CA, developed by Sen [38] and Nussbaum [28].

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