Me, Myself & Data - Principles for the Design of Self-Tracking Services

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ABSTRACT

In this paper, we will explore how applying principles of design research to the design of self-tracking services can lead to a more human and delightful user experience, and thus more desirable services. Design research has always aimed at helping design human-centered products and services. To do so, researchers follow various guidelines to ensure that the conducted research is relevant, ethical and inspiring. The rise of new technologies for the self-tracking of personal data has blurred the distinction between users and researchers as devices for self-tracking have become more mobile, wearable, and affordable for the mainstream, allowing users to become researchers of their own lives. Yet, having access to more data does not automatically mean people will understand this information, or know how to apply it. The main challenge, therefore, lies in interpreting the data and acting upon the information gained. We have conducted a series of interviews and analyzed concrete examples of self-tracking services, and based on our observations have defined five principles of design research. We believe that when applied to the design process, these principles will ultimately result in self-tracking data that brings more value to users.

Keywords: Self-tracking, Design Research, Human-Centered Design, Quantified Self

INTRODUCTION

Research for Human-Centered Design and New Challenges Around Data

Researchers for human-centered design collect and interpret data to uncover needs and inspire design solutions to better serve people's future needs, a process which always begins with considering the people for whom we are designing. Traditionally, human-centered design focuses on qualitative data, based on the belief that observing people in context and having in-depth conversations will lead to a better understanding of their latent needs – to inspire the next instead of just describing the now (Seemann, 2012). Lately, digital technologies have had a huge impact on how we do research (Berry, 2011), primarily because of the ever increasing amount of data produced in modern society. This omnipresent accessibility of data has added more variety to data collection methods. It is easier than ever to derive information from huge quantities of data that users have produced themselves, a circumstance that has added an interesting additional source of information to our work. While this has led to a new set of questions and challenges, our general guidelines of how we understand data and make it useable have remained the same. At its core, research for human-centered design is not just about analysis of objective evidence, but rather it is a way of informing our intuition – synthesis of evidence, recognition of emerging patterns, empathic connection to people's motivations and behaviors and intuitive interpretation of information from multiple sources (Fulton Suri, 2008).

Self-tracking of Personal Data

The human behavior of tracking personal data is nothing new. For a long time humans have collected information about themselves: qualitative information, as with a journal, but also quantitative information, like weight tracked on a scale or a financial balance tracked with a bank account (Wolf, 2010). What has changed is not the need to understand more about ourselves, but rather the technologies supporting data collection: electronic sensors becoming smaller and better, devices to track personal data becoming wearable, accessibility and affordability for the mainstream. A vast number of new products and services has appeared in the market, giving rise to new opportunities for people to collect and interpret their own personal data, with users have become researchers themselves. A term often used in the context of self-tracking is the Quantified Self, coined by Gary Wolf and Kevin Kelly of Wired Magazine in 2007. With the goal of connecting users and makers of self-tracking tools, and helping people get more meaning out of their personal data, they founded the California-based company, Quantified Self Labs, which regularly organizes international meetings and conferences. The topic of self-tracking and Quantified Self has been widely discussed in regards to technology, as well as research, with early adopters of self-tracking services often referred to as 'geeky' or even narcissistic (Kelly, 2011). According to Genevieve Bell (as cited in Simonite, 2013), an anthropologist and director of Intel's user experience research, this is partly due to the fact that with many of the early self-tracking services it was not completely clear how their technical features could actually enhance people's lives. The focus when talking about self-tracking services is too often on what they can do, the 'task' piece of it, rather than on how one can make sense of the information provided (2013). Another challenge discussed in the context of self-tracking is the lack of ways to help users act upon the data they collect. As Adam Tinworth, blogger for NEXT Berlin, asserts "the Quantified Self needs more actionable data," for only when we have more compelling examples of how data from self-tracking services can make a powerful difference in people's life, will the Quantified Self movement really move from the data enthusiasts to the mainstream (2013).

How Can We Make Self-tracking Services More Human-centered?

For design researchers the development of users tracking their personal data leads to various fascinating questions: What can we learn from users' behavior of tracking themselves? What can we learn from the data produced through self-tracking? While these questions continue to inspire and challenge us, we focus here specifically on one question: How can we design more human-centered self-tracking services and help users become better researchers of their own lives? As already stated above, two core questions in this context are the *purpose* of self-tracking – which human need does the service address – and the *outcome* of self-tracking – how does it enable users to act upon what they have learned. We discussed these questions in conversations with users and in interviews with colleagues, designers and scientists involved in the creation of self-tracking services. The broader basis for our conversations were the following three provocations:

More data – more value? New technologies have made it easier for people to track their personal data. Yet, the fact that people are able to track data does not necessarily mean the resulting knowledge is actually beneficial. We are convinced that the design of every self-tracking service has to start with understanding which existing or emerging need the service addresses, which problem it can solve or which behavior it can ease in the future. In addition, the value of a self-tracking service hardly lies in the data it provides, but rather in the insight that can be derived from this data. *How can the design of a self-tracking service benefit the user by moving beyond data towards actionable insights?*

More data – more 'truth'? Smart devices seem to do the math for us. By counting, measuring and providing numbers, they evoke the impression that all is objective and accurate. Yet self-tracking of personal data is, in itself, a very subjective matter. Data is never purely objective and interpretation of data is always as much an evaluation of oneself as of the data itself (Evgeniou, 2013). Even though a large part of the data tracked is quantitative by nature, the results produced are not necessarily 'facts', as the data is tracked and interpreted based on subjective observations and choices (Boyd & Crawford, 2011). As design researchers we believe that data cannot make decisions for us, but rather enable us to make better choices by informing our intuition (Fulton Suri, 2008). *How can a self-tracking service encourage users to draw upon their intuitive and interpretative skills?*

My data – my responsibility? Knowing more about themselves can potentially enable users to make better choices, more independently. For example, many self-tracking services exist in the realm of health and disease-management, potentially producing data that helps users take better care of themselves. Such data can lead to a new independence from doctors and hospitals, in turn giving users a new form of responsibility. However, this responsibility comes not without ethical implications, for who really owns the data? Who is responsible for interpreting and making decisions

based on the data? Taking these questions into consideration is also an important design challenge for self-tracking services. *How can a self-tracking service make users aware of and deal with the new risks and responsibilities it generates?*

LOOKING INTO EXAMPLES OF SELF-TRACKING SERVICES

Over the last year we have immersed ourselves in the world of new and emerging self-tracking services and related literature, and had many conversations with users about their motivations, habits, beliefs and and questions concerning the self-tracking of personal data. We interviewed several representatives from existing self-tracking services about their work: Arye Barnehama and Laura Michelle Berman, founders of Melon, a headband and mobile app that measures focus; Andrea Mallard, Chief Brand Officer at Omada Health, a service that inspires lifestyle change through evidence-based digital health programs, and Ethan Fassett, VP of Product at Basis, a health- tracking service that seeks to help users become fitter, sleep better and be less stressed. In addition we interviewed our colleagues Dirk Ahlgrim, Timothy McGee and Mitch Sinclair, of IDEO Boston, who, in the last year, have been involved in the design of several self-tracking services that are not yet on the market.

* Melon: Barnehama and Berman, the founders of Melon, set out to help consumers improve their focus to help them become more mindful, confident and productive. They developed a technology that enables people to better understand their own minds and transform their behaviors accordingly, resulting in a headband that measures brain activity and tracks mental focus. In 2013, Barnehama and Berman spent four months with a team of IDEO designers as part of IDEO Boston's Startup-in-Residence program, during which time they developed their user experience and prepared a Kickstarter campaign that nearly tripled the project's fundraising goal (IDEO, 2013).

* Prevent, Omada Health: Omada Health is a digital healthcare company focusing on preventable, chronic disease, that for the first time in history are killing more people than infectious diseases (CDC, 2011). Omada seeks to combine human-centered design with behavioral medical research to build programs that are enjoyable, social, and effective (Omada Health, 2014). Prevent, Omada Health's first product, aims at preventing type 2 diabetes. Sean Duffy, Omada's CEO, feels that most tech companies focus on making a service that consumers would love and not so much on clinical effectiveness, while medical companies focus on medical research but produce services that are not engaging enough to encourage usage. Omada's goal, in contrast, is to design a service that people would like to use and is also proven to work (as cited in Bradley, 2013).

* Basis: The self-tracking service Basis consists of a wrist-based health tracker and online personal dashboard to help people incorporate healthier habits into their daily routines. The Basis band continuously measures motion, perspiration and skin temperature and captures heart rate patterns throughout the day and night (Basis, 2014). "Every year, in their quest to become healthier, millions of people join a gym, start a new health program or download a fitness app," says Jef Holove, CEO of Basis, "often these approaches are too rigid to accommodate life's ups and downs, require us to log our lives manually, or can be too time-consuming to fit into our busy schedules. Basis solves these problems to help people build lasting healthy habits," (as cited in Chan, 2012).

Based on what we have observed in our daily work as design researchers, and from our conversations with users and the aforementioned experts, we have devised five principles that we believe are fundamental to our work as human-centered design researchers, as well as to the design of self-tracking devices: (a) ask the right questions, (b) move from data to insight, (c) move from insight to action, (d) tell a human story and, (e) ensure an ethical use of data. In the following section we will discuss these principles in the context of existing research and provide examples of how they apply to existing self-tracking services.

PRINCIPLES FOR THE DESIGN OF SELF-TRACKING SERVICES

Ask the Right Questions

It is tempting to get enthusiastic about the possibilities that technology offers for tracking personal data. The appeal of novelty can lead companies to design a service with an unclear goal in mind, and lead users to track personal data 'just because they can'. But this is often no more than an initial curiosity and not a sustainable motive for users to keep tracking in the long run. Benjamin and David, two passionate runners with whom we spoke, both discussed how they began tracking everything related to their runs, but soon got bored with it and finally ceased tracking altogether when it began to seem like too much hassle for what they got out of it. "When my current tracking device breaks, I won't bother to buy the next one," says David. As design researchers we believe that good research needs a clear purpose: What need are we trying to address? What problem are we about to solve? "Good design asks the right question", says IDEO's CEO Tim Brown (2009), every behavior change – exercising more, learning a language, changing job – always begins with asking the right question first (Brown, 2014).

The design of a good self-tracking service must start with the right questions. It should address a real need and it should enable users to ask the right questions themselves, while becoming increasingly aware of their answers. Melon's founders, for example, had a clear goal in mind when they started developing their technology: to empower people to know more about their own mind. "We want to help you focus better", says Arye Barnehama (personal communication, February 19, 2014). Further, "how could we transform the way we work? Improve the way we meditate? Find a new way to be creative?" (Melon, 2013). Melon is not about measuring brain activity, but about focus, feeling in control and feeling good about it, with the technology merely serving as a means of fulfilling this human need.

Understanding *why* people are tracking information about themselves is a central question that is not always so easy to answer. Besides very tactical motivations like losing weight or managing a chronic disease, there are also harder-to-grasp motivations, among them an almost philosophical desire to get a better sense-of-self, or a deeper understanding of oneself in relation to others. As Sinclair states, "self-tracking helps me to better understand who I am" (personal communication, February 14, 2014). By self-tracking, users might also want to tell a personal story about themselves. Bell (2013) discusses how wearable technology has a symbolic function in sending a message about ourselves and acting as a sign of belonging to a specific group, engaging in a specific activity or having specific beliefs. For the design of a good self-tracking service it is necessary to understand people's motivations before one can properly address them. In addition, what we learned from David and Benjamin's example of decreasing curiosity in their running data, is that motivations also change. The 'right question' in the beginning might be replaced by another 'right question' with time. As Ahlgrim, McGee and Sinclair describe it, "the perfect self-tracking device grows with you, as the engagement changes over time" (personal communication, February 14, 2014).

Move From Data to Insight

"People are not interested in getting more and more data, they want to understand what's going on. They are interested in the message," says Ahlgrim (personal communication, February 14, 2014). The value of a self-tracking service lies not in the data it collects, but in the insight it provides. Ethan Fassett, VP of Product at Basis, states that self-tracking services in general have to become better at confidently generating insights based on the data generated (personal communication, February 21, 2014). As design researchers we move from data to insight by synthesizing the information we have collected. We do this by cross-validating, contextualizing, filtering and interpreting the information. A well-designed self-tracking service should enable the user to make sense of the information by moving beyond the raw numbers and distinguish between important and irrelevant bits of information. Christian, early self-tracking adopter and self-proclaimed data enthusiast says, "in order to make sense of my data, I need to be able to put it into context," and criticizes that many self-tracking services lack the ability to connect and combine different sources of data.

Melon, for example, combines contextual information, such as current activity or environment, with data about brain activity measured by the headband, moving from data to insight and understanding about what factors affect our focus. According to Barnehama and Berman, "at Melon we are really interested in the idea of Understood Self, which we are trying to add to the movement of Quantified Self" (Melon, 2013), with the term 'Understood Self' describing the layer of insights on top of the numbers and scores. While many self-tracking devices leave it to the user to interpret the data and make decisions based on that information, Melon is specifically designed to interact with the user and provide messages about their focus based on the data collected (Treuhaft, 2013). Barnehama says "we didn't create a Quantified Self service. We are not just printing numbers. We believe Understood Self services are the Generation 2.0 of Quantified Self." He strongly believes that users don't want to "sit and look at data"

(personal communication, February 19, 2014). And self-tracker Christian confirms, "I'm not interested in the numbers, I want to see what it means for myself, how it compares to my own personal record."

The health-tracking service, Basis, automatically tracks and combines data from multiple sources and relies on the smart combination of different biosensors to provide better insight. Fassett says the continuous tracking of the users' heart rate, instead of just collecting data from an accelerometer, is a key factor in providing insights about what is really going on with the users' body (personal communication, February 21, 2014). Omada Health's service, Prevent, uses yet another approach to get from data to insight. Instead of relying on an algorithm to make sense of the data, a real coach does the work of interpreting, including not just the data obtained from self-tracking, but additional background information about the user, to provide more meaningful and relevant results (Mallard, personal communication, February 20, 2014).

Move From Insight to Action

As design researchers we believe that a good insight invites action, and should be inspiring, not simply descriptive. A well designed self-tracking service, therefore, should enable users to move not only from data to insight, but also from insight to action. Andrea Mallard, from Omada Health's service Prevent, states "we ultimately use the tracking to prompt a behavior rather than to accumulate data," (personal communication, February 20, 2014). When talking to users of self-tracking services, we asked them what they have learned from self-tracking and what impact it has had on their life. Aleksandra, a young biotech-scientist and passionate self-tracker, admits that although she loves self-tracking because she loves graphs and likes putting everything in a system to see the order of it, she did not really gain a lot of new information, nor did it really have much impact on her life. While there will always be users like Aleksandra, who like "self-tracking in itself," we believe Tinworth has a point when he says that self-tracking will only move from data enthusiasts to the mainstream when there is more actionable data that makes a real difference in people's lives (Tinworth, 2013).

Going beyond data by providing actionable insights is one of Melon's most important goals (Pugh, 2013). Melon learns, together with the user, what helps and what hurts one's focus and gives personalized recommendations when focus dips too low (Melon, 2013). For Melon, making data actionable is all about giving great real time feedback (Barnehama, personal communication, February 19, 2014). For example, the Melon app shows increases in concentration after performing certain tasks, with the user interface transforming from shades of red to shades of blue to help users determine an optimal study environment, or gauge when they have been working too long and need to take a break. The service not only helps users learn what affects their focus, but it also offers tips for improving focus and offers a game to help train your mental powers (IDEO, 2013).

Real time feedback about one's own body acts as a powerful tool in learning how specific actions lead to specific outcomes. As Nafus and Sherman state, "in situ awareness surfaces threads of other associations – what was eaten, the environment, the associated social dynamics, and so on. This gives a fuller experience of what changes in data, such as rising glucose levels, might physically feel like. One learns how to feel one's body through the data (Nafus & Sherman, 2014). Runner and self-tracker David, for example, reports that he learned through self-tracking how tired he would feel at a specific heart rate. And, Melon's Arye Barnehama tells a powerful story of how a child with attention deficit disorder (ADD) learned, through the use of Melon, to focus better by receiving feedback about how feeling focused is supposed to feel (personal communication, February 19, 2014). The direct feedback, in this case, acting as a trigger and positive reinforcement to lead to the desired behavior.

Short feedback-loops and personal recommendations based on real time data are huge opportunities for self-tracking services to move from data to action. As Ahlgrim states, by getting regular feedback users see and understand the impact of behavior change in real time, becoming aware of ways to improve their health by little changes in their everyday life (personal communication, February 14, 2014). It is exactly these little changes in everyday life that Basis is about. Basis wants to help users move to action by setting very specific and rather modest goals, like sitting less or having more consistent sleep times, and then use a gaming system and positive reinforcement to motivate those users to keep at it (Fassett, personal communication, February 21, 2014). Melon's Barnehama believes that timing is important and that embedding feedback and recommendations into people's day-to-day activities is integral, "a good service should give feedback in the moments that count." In the case of sleep-tracking, for example, users might get a score about their quality of sleep in the morning when they wake up, but then go through a full 12-hour day, doing all sorts of things that affect their sleep without getting feedback about those activities (personal communication, February 19, 2014). Omada Health's Andrea Mallard adds, that behavior change is not

always dependent on the actual data, but rather about the awareness that self-tracking induces, "people who track what they eat or weigh themselves every morning, will automatically eat less" (personal communication, February 20, 2014).

Tell a Human Story

Researcher Brenè Brown states in her TED talk "maybe stories are just data with a soul" (2010). As design researchers we embed stories into data (Seemann, 2012) to keep data human and the user at the center of our attention. When self-trackers track data they are creating a very personal story about themselves. As Gary Wolf (2010) describes it, "the goal isn't to figure out something about human beings in general but to discover something about yourself – the validity might be narrow, but it is beautifully relevant." In his 2010 TED talk, Wolf spoke about how data derived from self-tracking should not be exclusively seen as a 'window' that allows outside institutions to look into peoples' lives, but rather as a 'mirror' that allows self-discovery and self-awareness. Nafus and Sherman also discuss how the self-tracking of personal data is one of the few areas of big data collection in which the individual is not a resource whose data is aggregated and abstracted by a distant machine for the sake of advertising or controlling the behaviors of others, but instead is a meaningful reflection of oneself (2014).

Self-trackers have their own notion of analytics and represent a profoundly different way of knowing what data is and why it is important (Nafus & Sherman, 2014). "The relationship that people engage in with their self-tracking service is often very personal", says Ahlgrim (personal communication, February 14, 2014). Basis-user Cristina, for example, reports how the service feels like a friend telling her "this is how you feel, it's ok, just take a couple of breaths and calm down" (Basis, 2014). This personal nature of self-tracking should certainly be taken into account when designing a new service. Instead of applying a numbers-focused and abstract tone of voice, a good self-tracking service should address the fact that the data has been generated 'by myself, for myself' by adding a human layer to the data, allowing for subjective, intuitive interpretation. As Ahlgrim states, "a good self-tracking service acts as a translation tool, it enables natural conversations based on the data generated," (personal communication, February 14, 2014). Human subjectivity informs such natural conversations, and IDEO's Sinclair reports the frequent use of humor in the language of a self-tracking service to make it feel more human (personal communication, February 14, 2014).

At Melon there was conscious decision not to use numbers on a scale to communicate focus level, but to translate the data into something that users could understand on an emotional level, "Melon is about taking invisible information – in this case from your brain – turning it into something visible," says Barnehama (2013). Thus, they created a language with their users, resulting in the gradient on the app that turns from shades of red (stress, caution) to shades of blue (calm, refreshed) as the focus level improves (Barnehama, personal communication, February 19, 2014). Visual communication is often a good way to allow for more intuitive interpretation of data. Self-tracker Christian says "I would rather see the quality of my sleep in a circle or something, the numbers are just too abstract for me to interact with it." Dave Dickinson, former CEO of sleep-tracking service Zeo, strongly believes presentation matters, "some data charts and graphs simply have no chance to capture our fear or to engage our competitiveness," (2013). Health-tracking service Prevent also keeps data human by including real human interaction in their service. Calling it 'high tech meets high touch' Mallard describes the service as one part digital, and one part real life interaction with a health coach, who validates the data with meaningful stories (personal communication, February 20, 2014).

Ensure an Ethical Use of Data

Ethics around data are most often considered when the people analyzing and using the data differ from the ones producing it. The immense accessibility of data has given rise to much discussion about the ethical use of user provided information, with many suggesting that just because people publicly share information, it is not automatically ethical for others to make use of it (Boyd & Crawford, 2011). Ethical considerations are, of course, just as relevant when users track data for themselves. In this paper we have focused on the personal relevance of data and therefore have limited ourselves to ethical concerns related to the hypothesis of users becoming researchers of their own lives. Questions around security and confidentiality of data collected through self-tracking need to be answered on a societal, governmental and legislative level. It is imperative, however, that service providers ensure users are aware of how their data is stored and what it could be used for.

Our main goal here is to examine how self-tracking leads to new personal risks and responsibilities for the user.

Self-tracking tools can empower users in many ways: to learn more about themselves, ask better questions and make better decisions, more independently. Especially in the health domain can self-tracking lead to exciting opportunities: a more democratic distribution of knowledge, more independence from experts, patients who have more knowledge about their bodies, take better care of themselves and lead a healthier lifestyle that helps not just in managing diseases but also preventing them. At the same time questions of responsibility and liability are also more pressing in the field of health-tracking. As roles and responsibilities between different stakeholders are changing, we have to ask ourselves: who owns the data and who is responsible for interpreting it and making decisions based on it? Does the expertise lie with the service, with the user or with some external institution making sense of the data? With Omada Health's service Prevent, for example, the interpretation of data is not left up to the user, as they are often subject to biases, with seemingly 'neutral' self-tracking services often supporting those user biases (Mallard, personal communication, February 20, 2014). Instead, data from self-tracking is supplemented by the expertise of a real human health-coach, and decisions are based on conversations between the user and the coach. As Mallard states, "we don't rely on a program or an algorithm or even the user to do the work of interpreting all the data that comes in," (personal communication, February 20, 2014). Additionally, Wolf believes that the fact that electronic trackers are emotionally neutral, "makes them powerful mirrors of our own values and judgements," and further, "I got nothing from my tracking system until I used it as a source of critical perspective, not on my performance but on my assumptions about what was important to track," (2010). Thus, helping users become better researchers of their own lives through self-tracking also means making them aware of their new responsibilities, their biases and implicit judgments.

CONCLUSIONS

In this paper we have proposed five principles, derived from our work as design researchers, that should be kept in mind when designing new services for users to track personal data:

First, the design of a human-centered self-tracking service must start with *asking the right questions* and should continue to reframe those questions as the engagement with the service might change over time. Having the right questions in mind leads, as we have seen in the case of Basis, for example, to an outcome of more tailored feedback.

Next, a well designed self-tracking service should help users *move from data to insight* and *from insight to action.* Melon, as we have seen, uses contextual information to help the user learn more about what helps and hurts their focus and translates those into easy-to-grasp insights. By giving real-time feedback, Melon helps users not only receive valuable information to help develop a better understanding of their brain activity, but also helps them move to action and change behaviors based on their new understanding.

Throughout this process of moving from the right questions to relevant insights and desired actions, a human-centered self-tracking service should also *tell a human story* instead of merely focusing on abstract numbers and charts. We have seen services apply a humorous and playful language or use visual communication to enable natural conversations with the user based on the data collected, and encourage users to draw more upon their intuitive skills.

Lastly, self-tracking services need to *ensure an ethical use of data.* As stated above we primarily focused on understanding new risks and responsibilities that self-tracking implies for a user on a personal level. Knowing more about oneself does potentially lead to more independence in decision making, but also to more responsibility when it comes to interpreting data and acting upon the knowledge gained. We believe Omada Health has found an interesting way around this dilemma with Prevent. Instead of keeping the service purely digital, Prevent uses the data to inform conversations between the user and a real human health-coach. Interpretation and decision making happen in these conversations, building on additional personal information about the user.

As the market matures, we hope to see more examples of self-tracking services that will incorporate our five principles, leading to better designed services and more value for the user. From a design research perspective we are keen to see how self- tracking services will develop in the future. Will self-tracking become more pervasive? Will self-tracking devices become invisible or even implantable? Self-tracking technology is changing the way we conduct our research as users take on the role of researchers, becoming collectors of their own data. Our role as researchers increasingly changes from passive observers to active collaborators, working together with users to

collect and interpret data. We look forward to the additional learning opportunities gained as users increasingly interact with their personal data as researchers of their own lives.

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